

**WHITE
SERIES**

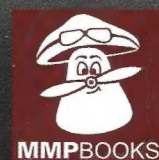
**Ognjan Petrović
Djordje Nikolić**

YUGOSLAV FIGHTER COLOURS 1918–1941

Vol. 2



Rainbow No 9149



Ognjan Petrović
Djordje Nikolić

Yugoslav Fighter Colours 1918–1941

Vol. 2

This book is dedicated to courageous Yugoslav airmen
who fought against all odds to protect their homeland 80 years ago

STRATUS

Published in Poland in 2021
by STRATUS s.j.
Po. Box 123,
27-600 Sandomierz 1, Poland
e-mail: office@mmpbooks.biz
as
MMPBooks,
e-mail: rogerw@mmpbooks.biz
© 2021 MMPBooks.
http://www.mmpbooks.biz

All rights reserved. Apart from any fair dealing for the purpose of private study, research, criticism or review, as permitted under the Copyright, Design and Patents Act, 1988, no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, electrical, chemical, mechanical, optical, photocopying, recording or otherwise, without prior written permission. All enquiries should be addressed to the publisher.

ISBN

978-83-65958-26-6

Editor in chief
Roger Wallsgrove

Editorial Team
Bartłomiej Belcarz
Robert Pęczkowski
Artur Juszczyk

*Research and Text
(in English) by*
Ognjan Petrović
Djordje Nikolić

Colour profiles
Ognjan Petrović

Proofreading
Predrag Miladinović
Roger Wallsgrove

DTP
Stratus sp. j.

Printed by
Wydawnictwo
Diecezjalne i Drukarnia
w Sandomierzu
www.wds.pl

PRINTED IN POLAND

Table of Contents

| | |
|--|-----|
| Hawker Yugoslav Fury (VV Fjuri – Fury) | 3 |
| Ikarus IK-2 | 31 |
| Hawker Hurricane Mk.I (VV Hariken – Hurricane) | 48 |
| Rogożarski IK-3 | 77 |
| Messerschmitt Bf 109E-3a (VV Me-109) | 101 |
| Potez 63 | 126 |
| Rogożarski R-313 | 136 |
| Zmaj R-1 | 142 |
| Ikarus Orkan | 154 |
| Messerschmitt Bf 110C-4 (VV Me-110) | 160 |
| Appendices | 163 |
| Bibliography | 169 |

Acknowledgements

This was an extensive and demanding project and without the help of fellow aviation enthusiasts around the world and historical institutions, we would have been unable to gather sufficient material to make this a definitive study of Yugoslav fighter aviation in the period between 1918 and 1941.

We would like to extend our gratitude to aviation enthusiast, historians, researchers and most importantly friends. They have offered their support, expert advice and selflessly shared their archives with us, which contributed to the quality of this book. Our gratitude rightfully goes to: Tomislav Aralica, Dan Antoniu, Marko Babić, Dénes Bernád, Boris Ciglić, Christophe Cony, Igor Černiševski, Robert Čopce, Giancarlo Garelo (the late), Roberto Gentili, Jan van den Heuvel (the late), Mario Hrelja, Alex Imrie (the late), Čedomir Janić (the late), Aleksandar Janković, Zoran Jerin (the late), Dalibor Jovanović, Aleksandar Kolo, Kees Kort, Dragan Kolundžić, Michel Ledet, Tihomir Likso, Marko Ličina, Marko Malec, Milan Micevski, Predrag Miladinović, Dejan Milojević, Miloš Milosavljević, Aleksandar Milošević, Nenad Miklušev, Josip Novak, Aleksandar Ognjević, Šime Oštrić, Malcolm Passingham (the late), Tomaž Perme, Dejan Petrović, Mario Raguž, Milorad Ristić, Dragan Savić, Aleksandar Smiljanić, Ruy Alexandre Aballe Vieira, Achille Vigna, Stanislav Džodžović (the late) and Janez J. Švajncar. We owe special gratitude to Predrag Miladinović for his expert advice, extensive help with proof reading our text and pointing out and correcting our unintentional mistakes.

Also, the following institutional archives provided us with valuable information which helped our research: Archives of Yugoslavia, Belgrade; Aviation Museum, Belgrade; City of Belgrade Library; Historical Archives of Belgrade; Military Museum, Belgrade; *Laboratoire Eiffel*, Paris; *Musée de l’Air et de l’Espace*, Paris; National Archives, Washington; Technical Museum Brno; National Digital Archive, Poland; ETH Zürich and *Österreichische Nationalbibliothek*, Vienna.

Last but not the least, we would like to thank our families for their constant support. Without their understanding of the long hours we spent away researching and writing, we could have not completed such an important project.

Kruševac – Seattle, summer 2019

Hawker Yugoslav Fury

(VV Fjuri – Fury)

Background

The Hawker Fury was without a doubt the best and the most appealing biplane in the period before World War II. It represented the pinnacle of British design and technological expertise. The Fury owes its success primarily due to: well chosen concept with clean aerodynamic features, high quality construction and especially the Kestrel engine whose performance made it a first true “fighter” engine with successfully designed compressor. The second major version, Fury Mk.II was the primary fighter aircraft type in RAF service until the end of 1938 (that is, until the introduction of low wing monoplanes), while Yugoslav Fury Mk.IIs participated in the April War operationally.

Engineer Sidney Camm, lead designer of H. G. Hawker Engineering Co., Ltd., designed Hawker Hornet fighter as a private venture, even though this aircraft was based on the RAF radial engine powered Hawker F.20/27 which made its first flight in 1928. The Hornet was a major sensation at the Olympia Aero Show in London in 1929 where had its public debut. In September of the same year, RAF began testing the Hornet prototype, now renamed Fury, and assigned RAF s/n J9682. At the same time, the Rolls-Royce F.XI engine was renamed Kestrel. The Air Ministry placed an order in August 1930 for the construction of 21 Furies in accordance with new technical requirements F.13/30. The lead aircraft (K1926) made its first flight on 25 March 1931 and already by the end of May the first 16 Fury Mk.Is were introduced in No 43 Squadron RAF.

Following the completion of testing, prototype Hawker Fury J9682 was returned to the factory which used it for a series of demonstration flights both in the UK and abroad. The Kingdom of Yugoslavia was one of the first countries which had the opportunity to witness the new aircraft. Before the RAF placed an order for the first series, in accordance with the tour of foreign countries in the first half of 1930, Hawker's test pilot Paul Ward Spencer “George” Bulman visited Belgrade flying the J9682. The aircraft caught interest of the VV and as a result the Yugoslav Government placed an order for three Furies at the beginning of 1931.

A total of 118 Fury fighters with Rolls-Royce Kestrel IIS engines were manufactured for the RAF. The factory implemented the improvements on one Intermediate Fury test aircraft, which had its first flight on 13 April 1932 while carrying the registration G-ABSE, and experimental High Speed Fury, which had its first flight on 3 May 1933 carrying the s/n K3586. To evaluate performance several different

*Fury Mk.I №1 taking off during an airshow at Borovo airfield on 12 May 1934.
(Robert Čopce)*



Pilot nar Ivan Šegatin posing in full flight suit while standing on the wheel of a Fury. Note that the wheel covers are removed. (Marko Malec)



engine types were trialed on both aircraft. In accordance with the technical requirements F6/35, 23 aircraft with Rolls-Royce Kestrel VI were ordered by Hawker Aircraft Ltd. (the factory changed name in July 1933). These aircraft were now designated by RAF as Hawker Fury Mk.II. The next 89 aircraft were ordered from General Aircraft Ltd., of which some were exported to South Africa. The first Mk.II took off on 3 December 1936 and served within RAF ranks until January 1939. Fury Mk.I was exported to Iran (16), KJ (3), Norway (1) and Spain (3). The newer Fury Mk.II was exported to Iran (6), KJ (10) and Portugal (3). In accordance with Hawker practice at the time, these aircraft were named Persian, Yugoslav, Norwegian, Spanish and Portuguese Fury, respectively.

Introduction into VV service

At the beginning of 1931, VV placed an order for three modern Hawker Fury fighters for evaluation, prior to making a final decision wheatear or not to introduce this type in service. The same year, 20 increasingly outdated Avia BH-33 fighters were introduced even though VV did not make a final decision which of the two shall be the main fighter aircraft within its ranks. Situation within VV required that its units be equipped at all costs with some type of a fighter aircraft. Due to world economic financial crisis, conflicting opinions within the various VV departments, a strong French pressure to purchase their aircraft or at least engines, the high cost of British aircraft as well as the inability to obtain license to manufacture the engines, the decision to purchase Hawker Fury was delayed until 1935 when the newest, improved, version Hawker Fury Mk.II was ordered and a license was obtained to manufacture them locally. Along with the delivery of Fury, three Hawker Yugoslav Hind Mk.I (modified) aircraft arrived as well.

The KJ expressed increased interest in 1935 for British aircraft and as a result sent in March of the same year a delegation to London (amongst others to Paris and Prague) to test and if possible, procure 40 fighters. At the time no purchase was made, however soon negotiations with Hawker Aircraft Ltd. and Rolls-Royce companies commenced along with inspection and testing of aircraft and engines. In October 1936 engineer *ppuk* D. Radovanović purchased the first 10 Rolls-Royce Kestrel XVIIS (S – super-



charger i.e. compressor) engines for 10 Furies to be delivered by Hawker Aircraft Ltd. by mid-July next year. Along with these, 40 engines for license-built Furies and 15 spares were delivered. This purchase enabled VV to finally introduce within its ranks a modern supercharged inline piston engine. Despite this, soon enough, the limitation of the biplane construction became evident and precious time was lost due to the delay with deciding the standard fighter type.

Armed with two Darne machine guns, in KJ it was declared as "aircraft for combat and pursuit" or "single engine combat aircraft with Rolls-Royce Kestrel engine". It was a standard and basic VV fighter type from 1936 onwards. When World War II started, technologically and tactically obsolete Fury was still used within VV and was intended to be removed from active service by 1941. This never took place because by the time Axis invasion took place in April 1941, insufficient number of new modern low-wing fighter aircraft were purchased which required that the Furies remain in service despite their low value in the upcoming conflict.

The first three Yugoslav Furies, similar to the RAF Mk.I type, were manufactured in parallel with the first series of 21 machines (K1926-K1946) for the RAF. The first flight of a Yugoslav machine took place on 4 April 1931 with "George" Bulman at the controls. The first two machines (manufacturer designations HF1-HF2) with 720 mhp (710 hp) Rolls Royce Kestrel IIS engine were delivered to VV in July 1931, less than a month after introduction into RAF service. The third aircraft (HF3), intended for trial and evaluation, was equipped with a French Hispano Suiza HS 12Nb, the engine which was the power plant used in VV's two-seat Breguet 197 biplane. This machine had its first flight on 27 August 1931 at Sayer and arrived to Belgrade in November of the same year. The intent of the VV Command was to place an order for at least 60 aircraft, of which 40 would be manufactured under license in the KJ.

Similar with the British, Fury Mk.IA was the first VV type which achieved a speed greater than 322 km/h (200 mph). The VV was extremely satisfied with the flight characteristics demonstrated by the Kestrel IIS engine, which had a declared maximum 1-min power of 558 mhp (550 hp) at 2,750 rpm at 3,505 m and maximum 5-minute power of 487 mhp (480 hp) at 2,250 rpm at take-off until 305 m. It is interesting to note that the Fury with the Hispano Suiza engine (known in VV as Fury-Hispano), which had a declared nominal power of 650 mhp (641 hp) at 2,000 rpm at sea level, exhibited poorer performance. The main reason for this was that the Hispano engine lacked a compressor. Despite the strong French influence within the ranks of VV, this engine was not chosen for the Yugoslav Fury.

Front view of a factory fresh Fury №3 (note: same as in the photo description below) pictured at Brooklands prior to delivery to KJ. Note Hispano-Suiza engine with distinctive exhaust pipes on both sides and large cooler under the nose. (Djordje Nikolić)

Factory shot of №3 (factory designation HF3), the last of the three Fury Mk.IAs purchased by VV. This machine, intended for test and evaluation, was equipped with a French Hispano Suiza HS 12Nb engine. Interestingly, there are two crossed wires between the cabane struts which were replaced by the third strut before delivery. Note the factory applied national insignia and the absence of rudder inscriptions. (Aviation Museum – Belgrade)



A brand new Yugoslav Fury Mk.II №7 prior to a test flight from Brooklands. This machine had its first flight on 14 September 1936 as the first of the 10 ordered Hawker-built Yugoslav Furies. Note the older Aldis gunsight and the absence of the oblique cabane strut.
(Dalibor Jovanović)



№7 in a slight left turn showing its sleek lines.
(Dalibor Jovanović)



Yugoslav Furies were used in 6.VP for training the best skilled pilots, propaganda flights as well as various competitions. Attending the Third International Flying Meeting in Zürich between 22 and 31 July 1932, the first place in single seat category was won by *kap Ik* Zlatko Štitić flying Hawker Fury Mk.IA №1 with large Black code number 90 on the fuselage.

All three Mk.IAs were on the list dated 1 June 1936 containing aircraft taking part in maneuvers: №1 (then at 6.VP), №2 (at VOG) and №3 with Hispano engine (at overhaul with Ikarus, with a note that it was going to be repaired).

Fury №2 was tested at VOG relatively late (1936-1937) and it most likely underwent detailed performance study with the purpose to purchase an additional batch of Furies. The same machine was used in the first half of 1936 for trials of three types of radio stations, domestic Mikron, British Standard and German Telefunken. The service of Fury Mk.IA in VV lasted relatively long. On 1 January 1938 VV listed two operational Fury Rolls-Royce 486 mhp with planned service in war time until the end of 1937 and in peace time until the end of 1939. Despite that, the April War saw only one Mk.I in service while the remaining two were destroyed while in active service, one in 1936 and the other in 1938.

Despite the failure of Fury-Hispano type, Yugoslav military was very interested to equip Fury with some of the new Hispano Suiza engines. This was the reason why Fury №3 (ex HF3) was sent again before the end of 1933 to Brooklands for engine replacement, this time to a new Hispano engine with a compressor. Since such engine did not become operational during the next two years, Fury designer, engineer Camm, decided on his own accord to equip №3 with French Lorraine 12Hfrs Petrel engine with nominal power of 720 mhp (710 hp) at 2,650 rpm at an altitude of 4,000 m. The factory previously flight tested one Hawker Hart which was experimentally equipped with Petrel engine to prepare for the installation in Yugoslav Fury. Petrel was chosen in the hope that the Yugoslav side would accept Fury with such engine, since VV already tested one experimental Breguet 19 with the same engine type. Fury №3 flew in 1934 with Petrel engine in Great Britain but VV did not accept it into service.

| Hawker Yugoslav Fury Mk.IA deliveries | | | |
|---------------------------------------|----------|------|--|
| Date | Quantity | VV № | Note |
| 7/1931 | 2 | 1, 2 | RR Kestrel IIS |
| 11/1931 | 1 | 3 | HS 12Nb |
| 1933 | (1) | 3 | Conversion, modified to RR Kestrel IIS |
| 1934 | (1) | 3 | Conversion, modified to Lorraine 12Hfrs Petrel |

| Aircraft Characteristics Hawker Yugoslav Fury Mk.IA (VV Fury Rolls-Royce) | |
|---|---|
| Quantity used: | 2 + 1 conversion (ex Fury Hispano mod to Kestrel) |
| Crew: | 1 |
| Years of Service: | 1931-1941 |
| Span: | 9.2 m (30 ft) |
| Length: | 8.1 m (26.7 ft) |
| Height: | 3.1 m (10.2 ft) |
| Wing area: | 23.4 m ² (252 ft ²) |
| Engine:* | One 487 mhp (480 hp) Rolls-Royce Kestrel IIS |
| Empty weight: | 1,190 kg (2,623 lb) |
| Loaded weight: | 1,583 kg (3,490 lb) |
| Maximum speed: | 333 km/h (207 mph) at 4,368 m (14,330 ft) |
| Climb to 3,000 m: | 4 min 30 s |
| Service ceiling: | 8,534 m (28,000 ft) |
| Maximum Range: | 434 km (270 ml) |
| Armament: | Two synchronized 7.7 mm M.30 (Darne Modèle 1930) machine guns |

* Rolls-Royce Kestrel IIS engine is assigned in the literature with various nominal powers. Over time, greater power was homologated by allowing the engine to operate at a higher number of revolutions. In the beginning the homologated power was 490 mhp (483 hp), then it was increased to 525 mhp (518 hp) and around 1933 it was increased again to 580 mhp (572 hp). In one VV document from 1938, the power of a Kestrel IIS was listed as 481-587 mhp (474-579 hp).

| Aircraft Characteristics* Hawker Yugoslav Fury Mk.IA (VV Fury Hispano) | |
|--|---|
| Quantity used: | 1 |
| Crew: | 1 |
| Years of Service: | 1931-1933 |
| Span: | 9.2 m (30.0 ft) |
| Length: | 8.4 m (27.4 ft) |
| Height: | 3.1 m (10.2 ft) |
| Wing area: | 23.4 m ² (252 ft ²) |
| Engine:* | One 650 mhp (641 hp) Hispano Suiza HS 12Nb |
| Loaded weight: | 1,772 kg (3,907 lb) |
| Maximum speed: | 400 km/h (248.5 mph) |
| Climb to 5,000 m: | 6 min 22 s |
| Service ceiling: | 10,000 m (32,810 ft) |
| Duration: | 1 hour 55 min |
| Armament: | Two synchronized 7.7 mm M.30 (Darne Modèle 1930) machine guns four 53 kg bombs (alternatively) |

* Data stated in *Vazduhoplovni podsetnik* (Aviation Notebook), standard aircraft table review published in 1938 by VV Command. Fury Hispano weights were considerably increased, payload was 398 kg (877.5 lb), even 2.5 times larger than the original Kestrel powered machine. Surprisingly, the top horizontal speed of even 400 km/h is stated!

Yugoslav Fury Mk.II, the best of all Furies

Before making a final decision, a special Commission was set up to evaluate the performance of two biplanes, the Hawker Fury and the Avia B-534. The winner of the contest, Fury, was selected due to the mistake with the currency conversion, which made Avia much more expensive, and the bias by the member of the Commission despite Avia's superior performance in climb rate, maximum speed, engine power, the ability to be equipped with engine mounted cannon as well as several other clear advantages.

The contract to purchase 10 Yugoslav Fury Mk.IIs and 65 Kestrel XVIS engines was signed on 19 September 1935. The manufacturing license was also purchased, and the contract allowed for the first Kestrel engines to be built locally after 16 months. By that time, the Kestrel engine was already obsolete.

Remarkable in-flight shot of
 №7 during factory trials at
 Brooklands airfield.
 (Malcolm Passingham via
 Mario Hrelja)



The first of the 10 ordered aircraft (№7) had its first flight on 14 September 1936 and the delivery of all aircraft lasted until June of next year. Yugoslav Furies were equipped with Gloster Gladiator like Dowty undercarriage legs, aerodynamically more streamline radiator, two 7.7 mm M.30 (Darne Modèle 1930) machine guns with 500 rounds per gun each (with option for two additional machine guns below the wings), Teleoptik-built gunsight (licensed French Collimateur Chretien E.T.Aé Modèle 1933) and the most powerful engine of all manufactured versions. As a result, Hawker Yugoslav Fury Mk.II (or Yugoslav Fury Series II) was the fastest of all Fury versions, with maximum speed was 389 km/h. The 1938 Yugoslav Aviation Yearbook cites with pride: "The last version of famous Hawker Fury fighter belongs to the first-class machines of today".

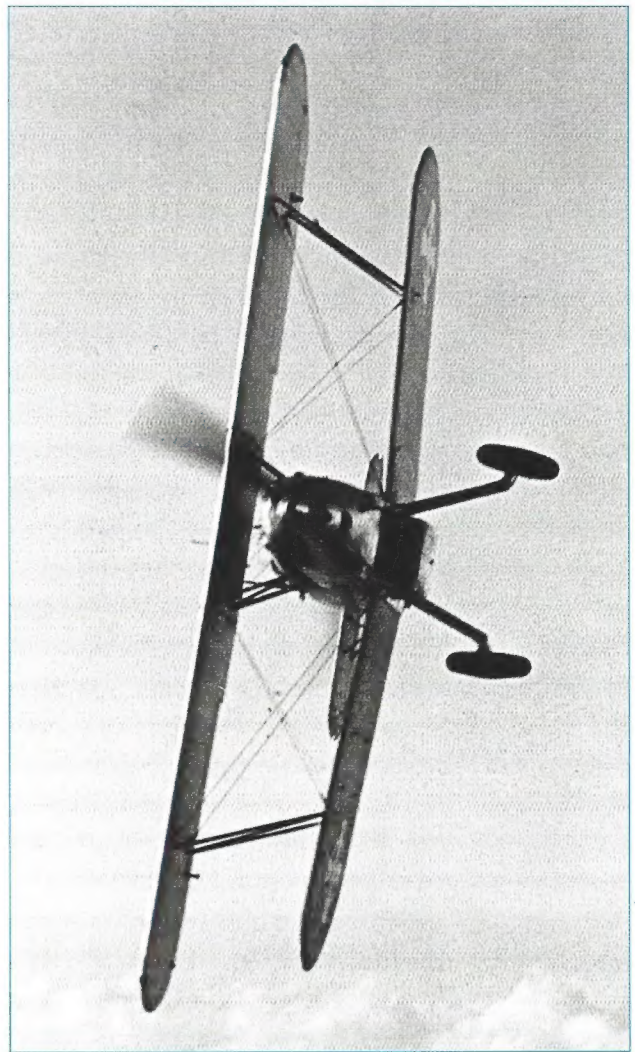
The engine, RR Kestrel XVIS developed 700 mhp (690 hp) at 2,600 rpm at 3,360 m and 730 mhp (720 hp) at 2,750 rpm at 3,650 m exploitation altitude. Maximum power was 755 mhp (745 hp) at 3000 rpm at 4,420 m. During their service Yugoslav Furies used three two-blade propeller types: the original British Watts B.274, imported German Schwarz and domestic type manufactured by Rogožarski A.D. German Telefunken Slat 276 F communication set, British-built inhalator (used between 3,000 and 9,000 m) and Irving parachute were standard equipment of VV Furies. Below the lower wings, instead of the under wing machine guns, Yugoslav Furies could be optionally armed with two racks for a total of eight 25 kg bombs, which enabled ground attacks as well. During the winter months, Furies had skis installed for snow operation. Skis were designed by *maj* Grigorije Fomagin, CO *Аеропланска радионица* (Aircraft Workshops) of 6.VP.

The license production of Furies was assigned to two factories. On January 1936 VV HQ signed a contract with Ikarus A.D. to produce 24 Furies and these were delivered from 9 August to 25 October

1937. The second factory, Zmaj A.D., began the production in 1936 and all 16 ordered aircraft were completed and delivered at the end of 1937 and early 1938. To rationalize production, factories agreed to send a team of experts together to England, split the expenses for production of special tools and molds and to secure the supply of raw materials and sub-assemblies from import sources, mostly from England and Germany. First machines were flight tested by VOG pilots *kap Ilk* Milan Pokorni and *kap Ilk* Adum Romeo. Thereafter testing and acceptance flights continued with *por* Petrović, Bjelanović, Dobnikar, *nar* Gorup and *ppuk* Šebaljin. The weights measurement, flights and ground testing showed that the domestic manufacturers delivered Furies which in all aspects matched the English ones.

All Furies, both imported and domestic-built, were assigned to the 6.VP based at the capital city, Belgrade. Until the spring of 1937, this Regiment consisted of two aviation groups, 125.VG and 127.VG. The third group, 126.VG, was created during the spring of the same year. A year later, during VV reorganization, 6.VP became a LP and all units were renamed. Furies were used as a standard and main VV fighter aircraft until the spring of 1939 when they were assigned to 4.VP in Zagreb which from 1 May of the same year became a LP. When this unit later began to re-equip with Hawker Hurricane Mk.Is, gradually it transferred its Furies to the 5.VP at Niš, which was created on 1 April 1939 and became a LP in the autumn of 1940. The first 18 Furies from 4.LP arrived at Niš on 18 June 1940. In the autumn of 1940, the newly formed 5.LP consisted of 21.VG (41.E, 42.E and 43.E), 35.VG (109.E and 110.E) and 610.TE. On 1 March 1941, 21.VG was redesignated to 36.VG with 111.E and 112.E.

Over time, the number of Furies in service began to gradually decline. On 1 January 1938, there were a total of 49 "new fighter type" Furies on strength (41 operational and 8 inoperable) at two 6.LP's aviation groups, 31.VG (101.E and 102.E) and 32.VG (103.E and 104.E). There were a total of 47 Furies on 1 April 1940 and 46 (35 operational and 11 struck off charge), now declared as "old fighter type" Fury, on 30 June. Due to the frequent flying a number of losses and accidents began to climb which resulted in 17 Furies struck off charge by April 1941. In the time shortly before the April



Although this photograph was taken over the UK prior to the delivery, such sight would be encountered during the April War by Luftwaffe Bf 109 pilots. (Malcolm Passingham via Mario Hrelja)



Above the clouds over Brooklands, Hawker test pilot taking this brand new Fury №7 for a steep climb. (Dalibor Jovanović)



Yugoslav Fury №7 entering a dive during one of the test flights over Brooklands. During the military exercise at Torlak near Belgrade in September 1940 VV Furies were used as a dive-bombers on the opposite side equipped with siren and cement bombs to imitate German Stukas. (Malcolm Passingham via Mario Hrelja)

№4 was the first s/n in the set of 10 aircraft from the imported batch. This machine carried factory applied standard VV national insignia and rudder inscriptions, aircraft type (HAWKER FURY) and s/n (№) on rudder flag Blue field and weight abbreviations – without weight values – on the White field. (Aviation Museum – Belgrade via Mario Hrelja)

greb, 24 July) and nar Faik B. Lačević (Zagreb, 24 July).

Yugoslav Fury Mk.II had better performance than other Furies. It was the most modern VV biplane fighter and it bridged the gap between obsolete biplanes and modern monoplane fighters. From the end of 1936 to the beginning of 1939 it represented the main VV fighter type, and due to the course of events it remained on strength at the first lines of defense until April 1941. Apart from military, Fury also had a significant technological importance for the domestic aeronautical industry.

The overview of VV aircraft from 1 January 1938 assigned service dates for Fury use in war time until 1939 and in peace time until 1942. In accordance with the "Overview of allowable flight hours until the end of service" from 1939, Furies were intended to fly 400 h until the first overhaul, 300 h until the second and the third, 200 h until the fourth and another 300 h until retirement. Following each 100 flight hours and 400 landings, the commission inspections took place. The total engine service life was 2,000 h with four planned overhauls.

War, only one Fury was undergoing repairs at Ikarus. On 6 April 1941 VV had a total of 29 Furies on strength, with 25 in 5.LP (plus an additional aircraft undergoing repairs at the unit workshop) and four unarmed in 3.PS, which were used for training only. Beside these aircraft, 3.PS had the last surviving Fury Mk.IA on strength.

A Zmaj-built machine was presented at the First International Aviation Exhibition in Belgrade held between May and June 1938, while another Zmaj-produced Fury was tested in 1939 with ski undercarriage by VOG. After the arrival of Furies to 6.VP, pilots formed a new aerobatic trio and practiced a program which was showcased on 5 May 1938 at a large air show announcing the Exhibition in Belgrade. A successful 20 minute long program by "three shining Hawkers", as reported by Aviation Herald, amazed tens of thousands of visitors. These fighters were piloted by Nikola Veljković, Antun Ercigoj and Borivoje "Farma" Marković, all *kap Ik*. A half an hour earlier, Ercigoj (flying a Fury fighter) and Miodrag Blagojević (in PVT fighter-trainer) presented air fighting above the aerodrome.

Pilot *mv IIIk* Josip J. Petrač was killed flying a Fury near Zemun on 25 November 1938 during a test flight. During the intensive training flying during 1940, according to the known information a minimum of four VV pilots died flying the Furies: *por* Milan M. Dimitrijević (Zemun, 18 April), *por* Božidar P. Milenković (Zagreb, 24 April), *por* Vladimir A. Gaberc (Za-



VV Fury at 1941 April war

5.LP was deployed in the vicinity of the border with Bulgaria with 35.VG (109.E and 110.E) based at the Kosačić war auxiliary airfield near Leskovac and 36.VG (111.E and 112.E) at Režanovačka kosa near Kumanovo. The Regiment's assigned task was the protection of south east sector of the Kingdom of Yugoslavia and air cover for the 3.BP bomber aircraft. At that time, 35.VG had a total of 11 Fury Mk.IIs on strength, with six assigned to 109.E and five to 110.E. In addition, four machines were out of service in the group workshop. 36.VG had a total of 14 Fury Mk.II on strength, with seven each assigned to 111.E and 112.E. On 12 March 1941, both groups dislocated to their wartime auxiliary airfields.

On 5 April 1941, the 110.E CO *kap Ik* Otokar Sep crash landed his Fury while landing at Kosačić airfield, striking it off charge in the most crucial moment before the German attack. On that day, to everyone's surprise, the combat alert status was cancelled. Despite of this, the aircraft remained well camouflaged at the perimeter of the airfield.

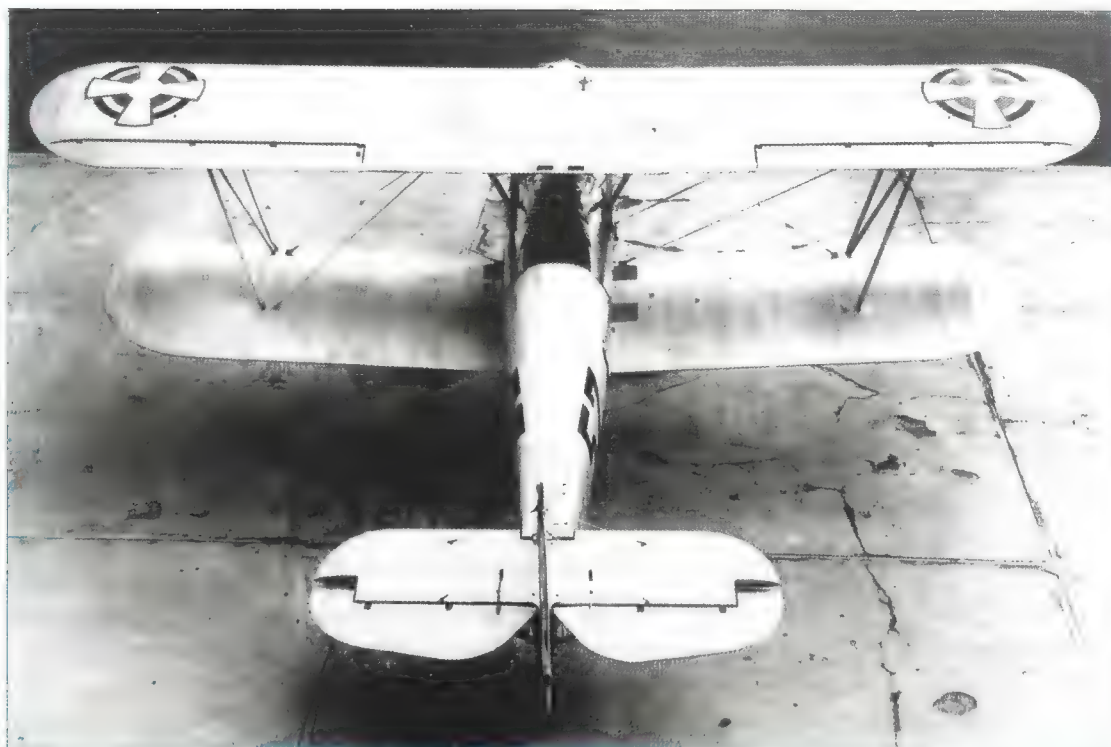
On 6 April 1941 at around 05:00, *ppor* Milan Damjanović, noticed a single engine aircraft coming from the direction of Bulgaria at 1,500 m altitude. The aircraft made several circles above Šarlinci airfield, war base of Breguet Bre 19/8 (Breguet Cyclone) two-seat biplanes from the Army Aviation unit 2.VIG (*Vazduhoplovna izviđačka grupa* – Aviation Reconnaissance Group). Following the departure of German reconnaissance machine, a group of 12 *Luftwaffe* Bf 109Es appeared waking up the Yugoslav pilots. All of them began running instinctively towards their aircraft without even wearing their flight gear. Despite their engines not being warmed up, Furies began taking off and the entire group of 10 aircraft from both *Escadrilles* slowly gained altitude. Despite the Yugoslav pilot's intention to take on the fight, Germans thought otherwise and sped away and were soon lost in the distance. At that time, as was the case numerous times in the short war, Yugoslav anti-aircraft defenses started firing on their own aircraft, fortunately causing no damage. Both *Escadrilles* began their combat patrols in the area, and Furies piloted by *ppor* Miodrag Jovanović and *mv IIIk* Krsta Stefanović flew towards Leskovac which was attacked by Ju-87s from St.G.2, however the attackers have already left the area. Six of the 35.VG Furies encountered 20 Ju-88s from I./LG.1 during the attack on Obilićevo plant near Kruševac, bombers sped up as they noticed the Yugoslav fighters approaching leaving Furies enough time to only attack in a single pass. During the attack, four of the Furies experienced jamming of their Darne machine guns after the initial bursts were fired resulting in no hits scored on the enemy bombers.

On 7 April, combat patrols by 35.VG repeated, this time patrolling at 4,000-5,000 m altitude without encountering any opposition, only establishing visual contact with one of the Yugoslav Bristol Blenheims from 1.BP which was returning from the bombing of German armored column. As the Group returned to their airfield, Bf 110 heavy fighters were observed overhead, but the Germans did not press on with the attack for unknown reason. Later in the day, heavy rain hampered effective combat air operations, while the German armored columns pressed on with their advance deeper into the Yugoslav

Another fine shot of №4 prior to delivery to VV. Note: mixed inscriptions – type of aircraft in Latin letters and weight abbreviations in Serbian Cyrillic letters, while stencils were in Latin letters. (Aviation Museum – Belgrade via Čedomir Janić)



Top view showing the location of "Kosovo Cross" insignia on the wings. (Josip Novak)



Fury №19 was the sixth machine of the 24 aircraft from the Ikarus-built batch. Note the Ikarus factory logo on the White flag field and service inscription ДИЖИ ОБДЕ (lift here) above the lifting hole. (Aviation Museum – Belgrade)



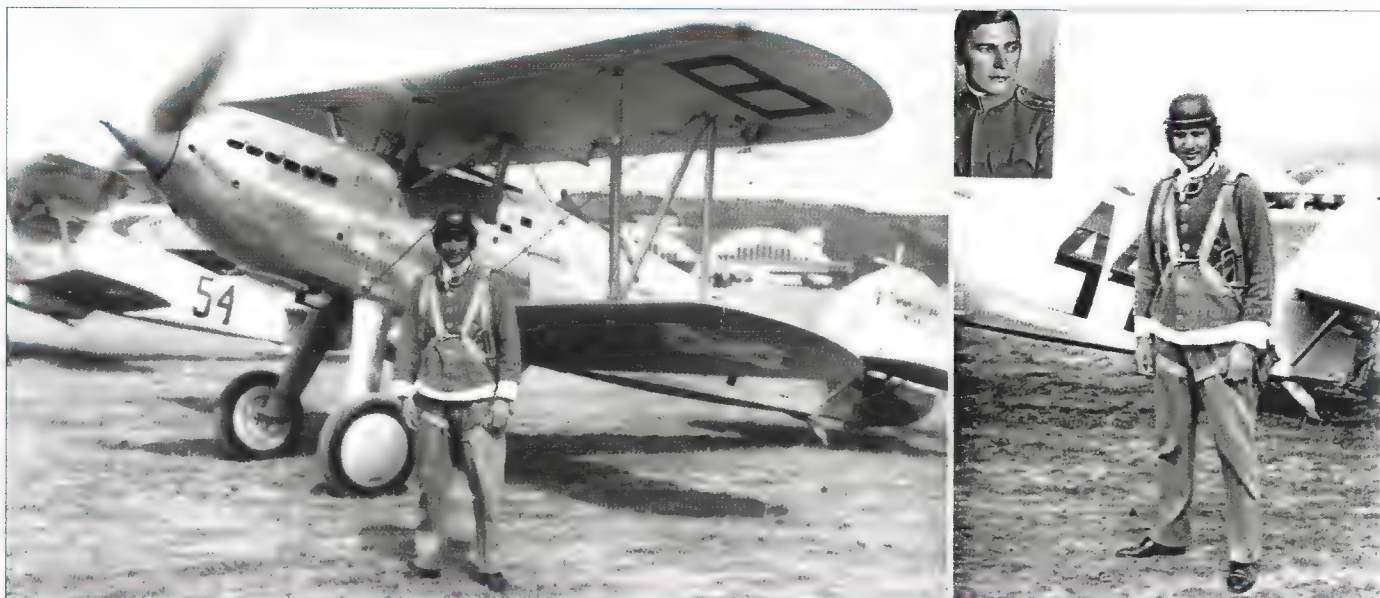
A line up of nine 6.VP Furies which, during a short period in 1938, carried special code markings (5-51 to 5-59) applied on the fuselage instead of the usual two-digit codes (so-called Escadrille numbers). Note Ikarus logo on the rudders of seven machines (5-53 to 5-59). (Aviation Museum – Belgrade)

territory. Despite the poor weather, ten Furies along with other group aircraft attempted to transfer to Kraljevo Airport but had to return. During the return flight, infantry fire damaged one of the Furies piloted by reserve pilot *ppor* Radovan Pisarev, who as a result force landed his aircraft near Čičevac unharmed but with significant damage to the aircraft.

To avoid capture by the advancing German troops, 35.VG was permitted to withdraw deeper into the Yugoslav territory towards the 2.LP airfield at Sušičko polje near Kragujevac. In the morning of 8 April, 35.VG made a successful attempt with the remaining aircraft to dislocate to Kraljevo and left one Fury at Kosančić. Once there, the controversial order was issued to torch the group's Furies as rumors of new Hawker Hurricane replacements began to arrive. Pilots and ground crews maintained their common sense and did not execute this questionable order.

On 10 April, 5.LP Headquarters and 35.VG personnel departed for Užice, while 35.VG aircraft remained at Kraljevo. As soon as they reached their destination the order to return was issued, pilots as a result turned their aircraft around and landed at Kraljevo at 01:00 the next day.





On 11 April, two patrols with three Furies each from 35.VG led by *kap Ik* Velimir Marković received the order to take off and fly towards Jagodina and observe the German advance and strafe ground targets. During the attack, Furies machine gunned German ground targets inflicting no visible damage but sustaining damage to two of their aircraft by the returning ground fire. During the return flight, patrols encountered strong friendly anti-aircraft fire, and *kap Ik* Velimir Marković's aircraft was damaged and subsequently shot down. The pilot fortunately bailed out and was discovered by friendly troops. He was taken hurriedly by the gendarmes through Kraljevo, since due to his blonde hair, the citizens thought he was German.

On 12 April, the ground component of 5.LP began its retreat and was followed on 13 April by the air component which took off for Butmir airfield near Sarajevo. That day, eight Furies took off from Butmir to defend Ilidža spa area during an attack but failed to encounter the enemy. As the rumors of arriving Hawker Hurricanes lingered on, this time that they would be delivered to Nikšić, 35.VG departed there on 14 April. During their flight, they engaged in a dogfight with 12 Italian fighters, claimed shot down two of the Italians while sustaining one of their own shot down with pilot *kap Ik* Manojlo Pejić bailing out never to be seen again. Later on it was discovered that he was wounded to his leg, survived with his family in Hercegovina and later joined the chetniks. As the Italian aircraft disengaged, the remaining seven Furies successfully landed at Kapino polje by Nikšić.

The last mission by the 35.VG took place on 15 April, when two Furies were tasked with escorting a Yugoslav SM-79 (Savoia Marchetti SM.79I) heavy bomber with Prime Minister *arm den* Dušan Simović on board to Greece. They escorted the bomber to the coast before turning back and landing at Grab airfield.

Two shots of 6.LP Fury №43 "Black 44" from Beograd Airport, July 1938: (left) with engine running, pilot *kap Ilk* Miloš Žunjić in complete flying suit with parachute is ready for take off in his machine. Note the large letter B below the top wing which indicates that the aircraft was based at Beograd Airport; (right) The same pilot and the same machine several minutes before. (Miloš Žunjić family via Predrag Miladinović)



Likely one of the Furies from the Zmaj-built batch is shown here in flight during June 1938. The aircraft has "Black 53" Escadrille number on the fuselage. Note the barely visible Zmaj factory logo on the fin. (Miloš Žunjić family via Predrag Miladinović)

Another shot of three VV pilots in front of a Belgrade-based Fury Mk.II. Maj Artur Kirasić is in the middle. (Mario Raguz)



With frequent use, accidents were bound to happen. Shown here is №11 "Black 37" from the imported batch sitting on its nose following a landing mishap at Beograd Airport in 1938. Note many stencils in Serbian language. (Milan Micevski)

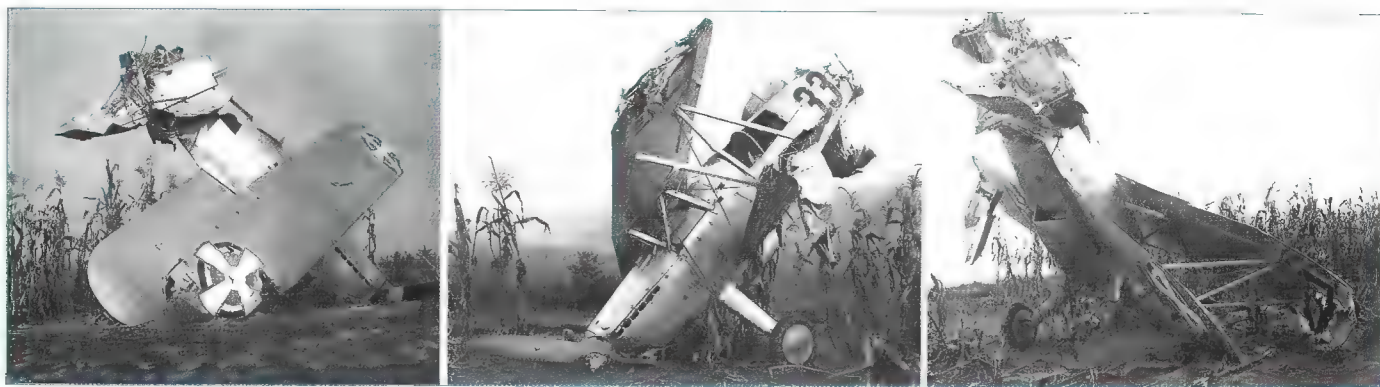


The day before the attack, on 5 April, 36.VG CO *maj* Drago Brezovšek flew over to Niš, and as his replacement 5.LP deputy CO *maj* Džal's arrived. The war path of 36.VG began early on 6 April at around 04:30 when a telephone call woke up the sleeping pilots who were in full combat gear in a pit house ordering them to take off and intercept enemy aircraft flying from the direction of Bulgaria. *Por* Živomir Stepanović and reserve *ppor* Oleg Kurganski from 111.E were already in the air during the morning patrol. The first to take off and join the two Furies were CO of 111.E *kap* *Ik* Vojislav Popović, *por* Milorad Tanasić and *nv* *IIIk* Milorad Radević. Just as the group took off another notice came of further six enemy aircraft. At that time the German attack commenced with strafing attacks against the Furies on the ground preparing for take off, which in the first wave almost cost the life of *nv* *IIIk* Stevan Ladar whose Fury caught on fire. Stepanović and Kurganski observed the attack on the airfield from 2,500 m and having observed German Bf 109Es went in for an attack but were attacked by two other Messerschmitts which they failed to observe while diving. Stepanović was hit in the tail by a cannon shell and began to dive towards the ground and crash landed into the trees. Before pilot could escape the mangled wreckage, he was strafed by *Luftwaffe* fighters. Kurganski was also shot down but managed to bail out.

The CO of 36.VG *maj* Drago Brezovšek flew in from Uroševac in the midst of combat above without being noticed by the *Luftwaffe* fighters and managed to land at Režanovačka kosa. He sought shelter in the command hut on the ground.

During this 10 minute encounter, four Furies were shot down by *Lt.* Fritz Geiřhardt, three by *Oblt.* Erwin Clausen and three other pilots claimed one Fury each. All Furies out of 14 on strength were out of action, with eleven shot down and three strafed on the ground (including 5.LP deputy CO *maj* Džal's aircraft), hence the group effectively ceased to exist as a combat unit. One Fury was destroyed in a suicidal crash and one crashed when *nv* *IIIk* Milorad Radević attempted to land at the auxiliary airfield near Gnjilane. Due to devastating losses, 36.VG did not take part in any combat operations for the remainder of the war. Germans lost one Bf 109 and Bf 110 each (with three flyers and one war correspondent dead) and one damaged Bf 109 which belly landed on its airfield.

Germans captured a total of nine Furies, one at Ikarus A.D. factory (EvBr 2225) and eight at Belgrade (possibly 2210, 2213, 2229, 2232, 2242, 2247). From the eight captured at Belgrade, all were scrapped due



Above: Totally destroyed Fury №7 "Black 33", after an accident on 21 September 1938. The pilot, kap Ilk Borivoje "Farma" Marković, survived. Note the Schwarz logo on the propeller blade. (all Aleksandar Ognjević)



Below: Pilot por Vilim Acinger in front of a camouflaged Fury at Belgrade, September 1940. A new VV two-tone camouflage scheme consisting of Dark Brown and Dark Green irregular patches on upper surfaces was first applied during 1940. Note underwing racks. (Milan Micevski)

Above: Fine shot of "Black 51" from 6.VP during 1938 trials at VOG (Aviation Test Group). Four underwing hard points and skis installed for snow operation are clearly visible. Skis were designed by engineer maj Grigory Fomagin, CO Аеропланска радионица (Aircraft Workshops) of 6.LP. (Milan Micevski)

to a deliberate act of sabotage and one from Ikarus was handed over to the newly established Croatian Air Force. The sole Croat Fury (new s/n 3401) was struck off charge following an accident in April 1942 in Zagreb. Fury which was at the 5.LP workshop at Niš was transferred to Paraćin airfield and was destroyed during a Partisan diversion in the night of 18 to 19 July 1941.

The Italians captured nine Furies at Kapino polje airfield near Nikšić, Montenegro. Two of these were Fury Mk.II №2230 "White 53", №2219 "White 54" from 3.PS and "White 10, 29, 41, 43, 44, 45 and 46" from 35.VG. Regia Aeronautica used three of them in Tirana, four at Nikšić and two at Guidonia. Two of the Furies in Guidonia (Escadrille codes 46 and 53) were evaluated at 1° Centro Sperimentale and were joined during June 1942 by further machine (№2219 "White 54"). It is unknown what happened to these aircraft but most likely they ended up being scrapped due to their obsolescence. It is also important to note that one Fury Mk.IA, most likely №3, was destroyed at Mostar Airport during the attack by Regia Aeronautica.



| VV Yugoslav Fury Order of Battle, 6 April 1941 | |
|--|------------------------------|
| 5.LP (CO <i>ppuk</i> Leonid Bajdak) | |
| 35.VG (CO <i>maj</i> Vasilije Živanović), auxiliary war airfield Kosančić near Leskovac 109.E (CO <i>kap</i> <i>Ik</i> Pavle Goldner) 110.E (CO <i>kap</i> <i>Ik</i> Otokar Sep) | - 6 Fury 5 Fury |
| 36.VG (CO <i>maj</i> Drago Brezovšek), auxiliary war airfield Režanovačka kosa near Kumanovo 111.E (CO <i>kap</i> <i>Ik</i> Vojislav Popović) 112.E (CO <i>kap</i> <i>Ik</i> Konstantin Jermakov) | 1 BH-33 7 Fury* 7 Fury |
| 3.PS (CO <i>maj</i> Vladimir Tihomirov) | |
| 2 nd Detachment, auxiliary war airfield Kosor near Mostar | 4 Fury** 1 Fury Mk.1** |
| * plus one machine was at Niš undergoing overhaul | |
| ** non-combat machines | |

| VV Fury in 1941 April War (reconstruction) | | | | | | |
|--|------|------|------|------|------|---------|
| 5.LP* | | | | | | 3.PS |
| 2202 | 2209 | 2222 | 2231 | 2240 | 2248 | 2201** |
| 2203 | 2214 | 2223 | 2233 | 2241 | | 2219 |
| 2204 | 2217 | 2226 | 2237 | 2243 | | 2230 |
| 2205 | 2220 | 2227 | 2238 | 2244 | | 22xx*** |
| 2208 | 2221 | 2228 | 2239 | 2246 | | 22xx*** |
| * One of these fighters was flown by <i>nar</i> Bogdan Rašić to 5.LP Aircraft Workshop at Niš. | | | | | | |
| ** Sole Fury Mk.I №3, probably 2201. | | | | | | |
| *** Unknown EvBr of two aircraft from 3.PS. | | | | | | |

| VV fighter-pilots killed in Furies during 1941 April War | | |
|--|---------------|--|
| Rank, name and surname, role | Unit | Date and place of death |
| <i>kap</i> <i>Ik</i> Vojislav J. Popović CO 111.E | 36.VG 5.LP | 6 April 1941, auxiliary war airfield Režanovačka kosa (aerial battle with German fighters), Air Defense Kumanovo region |
| <i>kap</i> <i>Ik</i> Konstantin A. Jermakov CO 112.E | | |
| <i>por</i> Milorad D. Tanasić | | |
| <i>ppor</i> Milutin D. Perović | | |
| <i>nar</i> Ratomir D. Milojević | | |
| <i>nar</i> Jefta Ž. Arsić | | |
| <i>nar</i> Veroljub D. Stojadinović | | |
| <i>mv IIIk</i> Milorad A. Radević* | | |

* fatally wounded, died at Gnjilane hospital



Mechanics posing in front of №2211 "White 11" at Zagreb Airport during summer 1940, a little before Hawker Hurricane arrived in inventory of 4.LP. (Dragan Kolundžić)

Camouflage and markings

Type designations

The original Hawker designation Yugoslav Fury was assigned to three VV machines from 1931. In VV service, aircraft were known as Hawker-Fury, Fury or Fury Rolls-Royce. From 1936, when new version, Yugoslav Fury Mk.II appeared, the original Furies were redesignated to Fury Mk.I and Yugoslav ones Yugoslav Fury Mk.IA or Fury Series IA.

Hispano-powered machine, Hawker Fury Mk.IA mod, was known in VV jargon as Hawker Fury-Hispano.

Ten imported machines were designated as Hawker Yugoslav Fury Mk.II or Yugoslav Fury Series II, while VV officially used Hawker Fury. License-built machines also used the same VV designation. VV did not make a difference between aircraft originating from different manufacturers, all aircraft with the same engine represented the same type.

All Furies in VV service were commonly known as *Fjuri* (Fury), or *Hoker Fjuri* (Hawker Fury), while designation Fury Series II (in Serbian, of course) were often used by VV personnel.

Serial numbers and codes

In accordance with the standard VV aircraft marking practices, aircraft manufactured in Great Britain, starting with the Hawker Fury (Mk.IAs) were assigned numbers №1-№3 (HF1-HF3) and later delivered ten Yugoslav Furies (Mk.IIs) №4-№13. The domestically produced Furies (Mk.IIs) manufactured by Ikarus A.D. were assigned №14-№37 and those by Zmaj A.D. №38-№53. Domestically manufactured aircraft additionally had the factory logo applied across the White tail surfaces.

Furies carried a large double-digit *Escadrille* number (code) on the fuselage, painted in Black colour. During the short period in 1938 some Furies had special markings applied on the fuselage after the *Escadrille* numbers, of those only 5-51 to 5-59 are known.

While Furies were assigned to 6.LP and based at Beograd Airport in Zemun near Belgrade, all machines had a Latin letter "B" applied in Black colour below both of the top wings towards the wing tips. This practice was common, and it designated the airfield at which aircraft were based.

To make the double-digit *Escadrille* numbers more visible against the new dark camouflage, the numbers were repainted in White colour. With the introduction of EvBr, Furies were assigned EvBr from 2201 which were applied on the fuselage and in some instances even on the rudder.

National insignia and inscriptions

The original national markings consisted of 114 cm (45 in) diameter "Kosovo cross" insignia in four positions on top of upper and below the lower wings. The rudder was painted entirely in Yugoslav

Another shot of №2211 "White 11" at Zagreb, early 1940. Note the EvBr 2211 applied on the rudder in the form of №2211, the opposite of the common practice without №. (Marko Ličina)



Blue-White-Red tricolour. Aircraft type (HAWKER FURY) and s/n (№) were factory applied on British and Yugoslav-built aircraft in Black over Blue field on the flag. Four weight values were applied over the White field. These inscriptions disappeared with introduction of new camouflage schemes.

Parallel with new two-tone scheme and EvBr system, new asymmetrical national insignia marking system was introduced. According the rules, two “Kosovo cross” with different diameters were adopted. Upper side insignia diameter was reduced to 65 cm and applied on port side of the upper wing only. Underside insignia had 100 cm diameter and was applied below the starboard lower wing only. Nevertheless, the common practice was to use two insignias under both lower wings. Some machines carried three 100 cm diameter “Kosovo cross”, one on starboard upper wing (opposite of rules) and two under both lower wings, which was Zmaj factory practice.

Camouflage schemes

Both Hawker Yugoslav Furies, Mk.IA and Mk.II, manufactured in Great Britain and those manufactured in the country were delivered in standard Aluminum dope colour painted over all fuselage and wing fabric surfaces, with the exception of the engine panels which remained in highly polished natural Aluminum.

A new two-tone camouflage scheme consisting of Dark Earth and Dark Green irregular patches on the upper surfaces was applied during 1940, while the lower surfaces remained in Aluminum (metal covering) and Silver dope (fabric surfaces).

| Yugoslav Fury Mk.II deliveries | | | | |
|--------------------------------|----------|-------|---------|--------------------------------|
| Delivered by | Quantity | VV № | Company | Note |
| 7/1937 | 10 | 4-13 | Hawker | Imported batch |
| 12/1937 | 24 | 14-37 | Ikarus | 1 st domestic batch |
| 7/1938 | 16 | 38-53 | Zmaj | 2 nd domestic batch |

| VV units equipped with Yugoslav Fury Mk.II | | | |
|--|-----------|---------|--|
| Unit | Period | Base | Note |
| 6.VP | 1936-1938 | Beograd | Also other types; 6.LP from early 1938 |
| 6.LP | 1938-1939 | Beograd | Furies handed over to 4.LP |
| 4.LP | 1939-1940 | Zagreb | Furies handed over to 5.LP |
| 5.LP | 1940-1941 | Niš | Furies entered the April War |
| LPŠ 6.VP | 1937 | Beograd | Reformed in 3.PS on 1 January 1938 |
| 3.PS | 1938-1941 | Niš | Also Hurricane and Me-109 fighters |

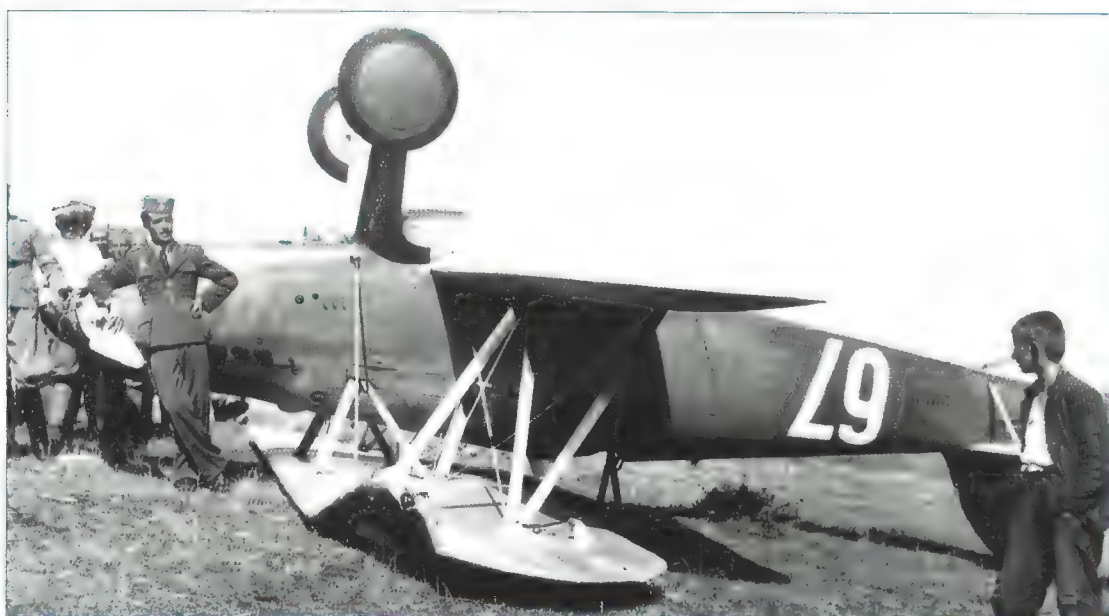
| Aircraft Characteristics Hawker Yugoslav Fury Mk.II (VV Fury) | |
|---|---|
| Quantity used: | 40 (10 Hawker-built, 24 Ikarus-built, 16 Zmaj-built) |
| Crew: | 1 |
| Years of Service: | 1937–1941 |
| Span: | 9.1 m (29.9 ft) |
| Length: | 8.2 m (26.8 ft) |
| Height: | 3.1 m (10.2 ft) |
| Wing area: | 23.4 m ² (252 ft ²) |
| Engine:* | One 720 mhp (710 hp) Rolls-Royce Kestrel XVI |
| Empty weight: | 1,482 kg (3,268 lb) |
| Loaded weight: | 1,772 kg (3,907 lb) |
| Maximum speed: | 390 km/h (242 mph) at 4,267 m (14,000 ft) |
| Climb to 3,048 m: | 3 min 45 s |
| Service ceiling: | 9,052 m (29,700 ft) |
| Maximum range: | 636 km (395 ml) |
| Endurance: | 2 h 50 min |
| Armament: | Two synchronized 7.7 mm M.30 (Darne Modèle 1930) machine guns Two optional machine guns of same type mounted below the wings, or eight optional 25 kg bombs on under wing racks |

* According to the factory instructions (Rolls Royce Ltd, Derby, August 1936), Kestrel XVI engine had a nominal power of 669,24-699,66 mhp (660-690 hp) at 2,600 rpm at nominal exploitation altitude of 3,353 m and a maximum power of 719,94-750,36 mhp (710-740 hp) at 3,000 rpm at 4,420 m altitude.

** Different weights were given on rudder inscriptions for license-built Yugoslav Furies: empty weight 1,380 kg (3,043 lb) and loaded weight 1,768 kg (3,898 lb).

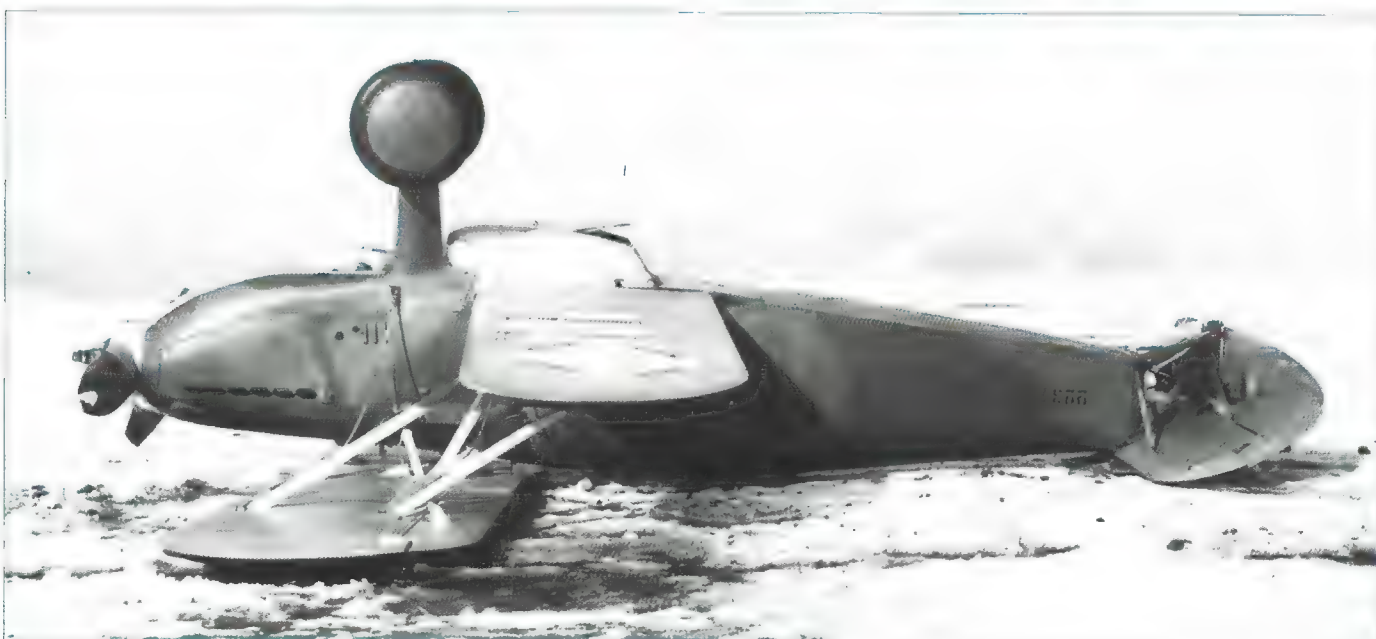


In addition to the new camouflage, Furies received White fuselage Escadrille numbers (codes) and newly-introduced VV s/nos or EvBr (so called евиденцијски број – evidence number) usually applied in Black on the rudder or the fuselage over the camouflage colours. Here, 2233 “White 18” is presented at VV Armament Exhibition at Belgrade Airport on 27 April 1940. (City of Belgrade Library via Milan Micevski)



Overtaken Fury of nar Slobodan M. Vorgić from 110.E, 35.VG, 5.LP at Pešter highland close to the town of Sjenica in Serbia, 26 September 1940. First on the left, Vorgić stands unharmed in front of the damaged Fury 2229 “White 67”. (Milan Micevski)

Nar Vasilije Vračević's landing accident with a Fury 2237 at snow covered airstrip at Beograd Airport, winter of 1939/1940. Absence of White fuselage code is strange in light of VV regulations. (Dejan Petrović via Aleksandar Ognjević)



One of the many VV Fury accidents in the period between 1938–1940. Shown here is Fury 2210 "White 14" equipped with Fomagin type skis. (Šime Oštrić via Ognjan Petrović)



A line up of VV aircraft captured by the Italians at Kapino Polje auxiliary war airfield near Nikšić, June 1941. In the foreground is Fury 2230 "White 53", while behind it are two ex-VV machines (Zmaj FP-2 "White 40" and Rogožarski PVT) and Italian Air Force Caproni Ca.311. (via Boris Ciglić)

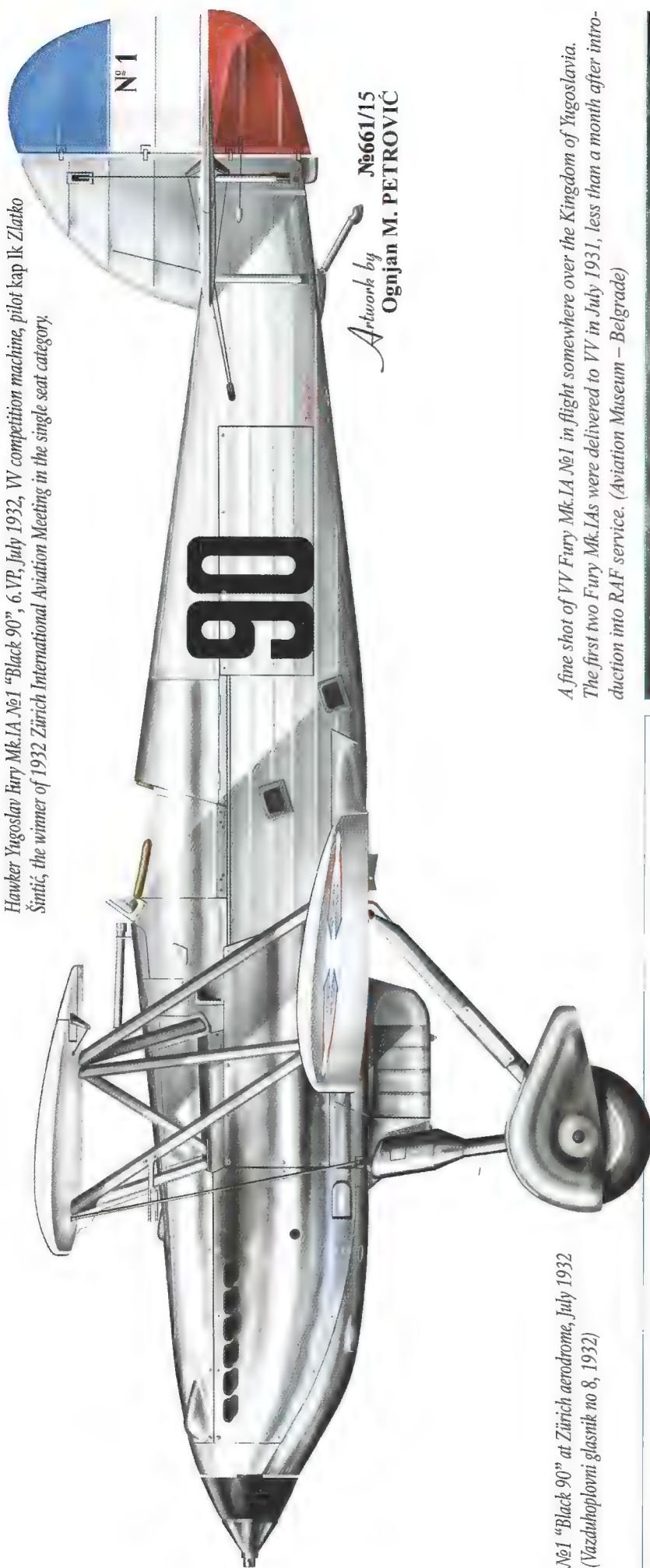


A German infantryman posing beside a destroyed Fury of 5.LP. Por Živomir Stepanović from 111.E made an emergency landing near Preševo after a dogfight with superior Luftwaffe Messerschmitts over the Kumanovo-Skopje road on 6 April 1941. (Aviation Museum – Belgrade)



Captured Yugoslav Furies shown here are two machines at the 5.LP Aircraft Workshop at Niš photographed by the Germans after the 1941 April War. (Aviation Museum – Belgrade)

Hawker Yugoslav Fury Mk.IA №1 "Black 90", 6.VP, July 1932, VV competition machine, pilot kap Ik Zlatko Šimtić, the winner of 1932 Zürich International Aviation Meeting in the single seat category.

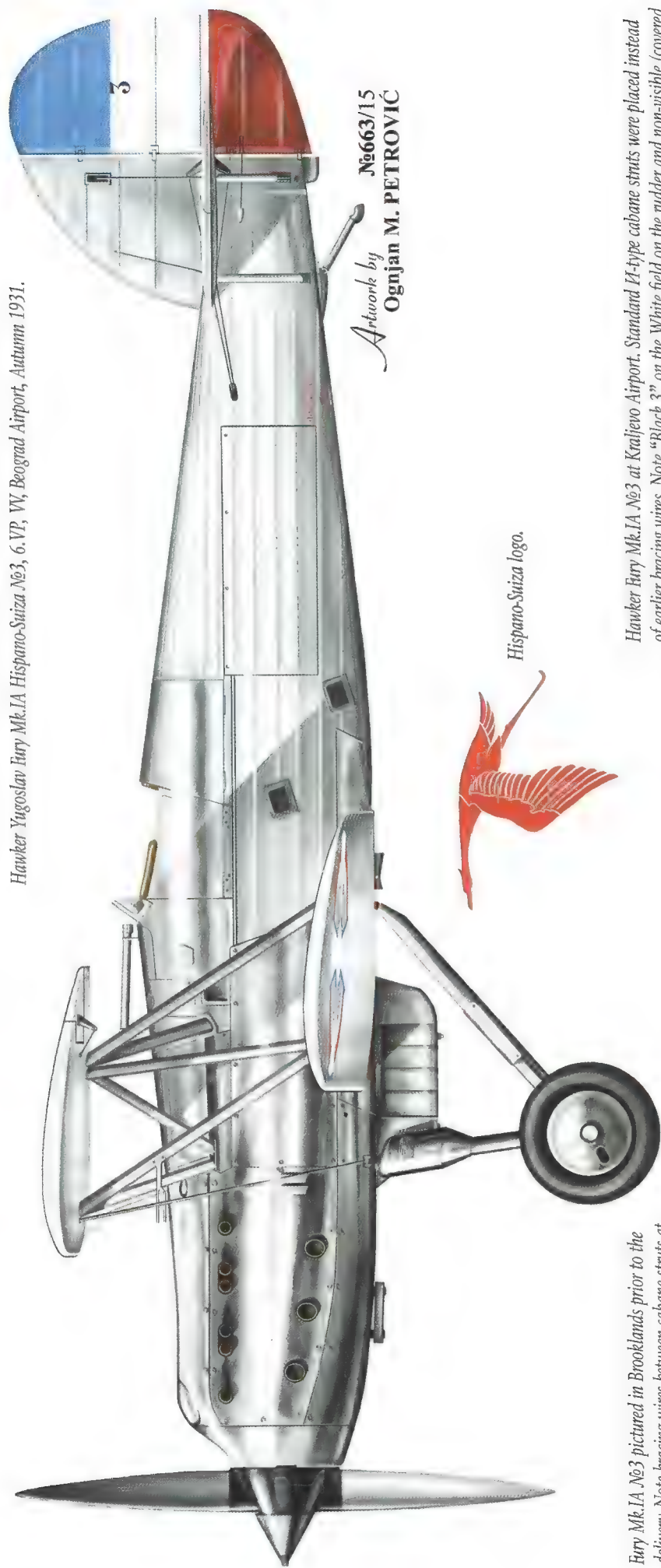


Artwork by
Ognjan M. PETROVIC

№1 "Black 90" at Zürich aerodrome, July 1932
(Vazduhoplovni glasnik no 8, 1932)

A fine shot of VV Fury Mk.IA №1 in flight somewhere over the Kingdom of Yugoslavia.
The first two Fury Mk.IAs were delivered to VV in July 1931, less than a month after introduction into RAF service. (Aviation Museum – Belgrade)



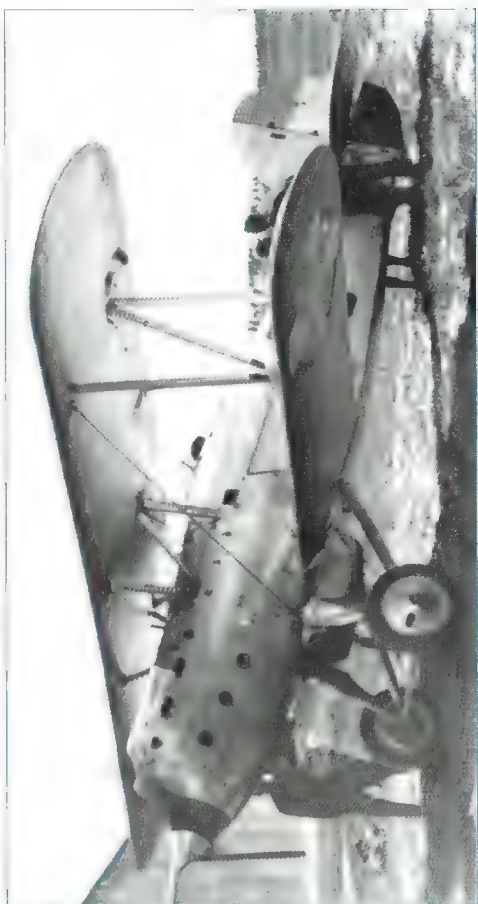


Hispano-Suiza logo.

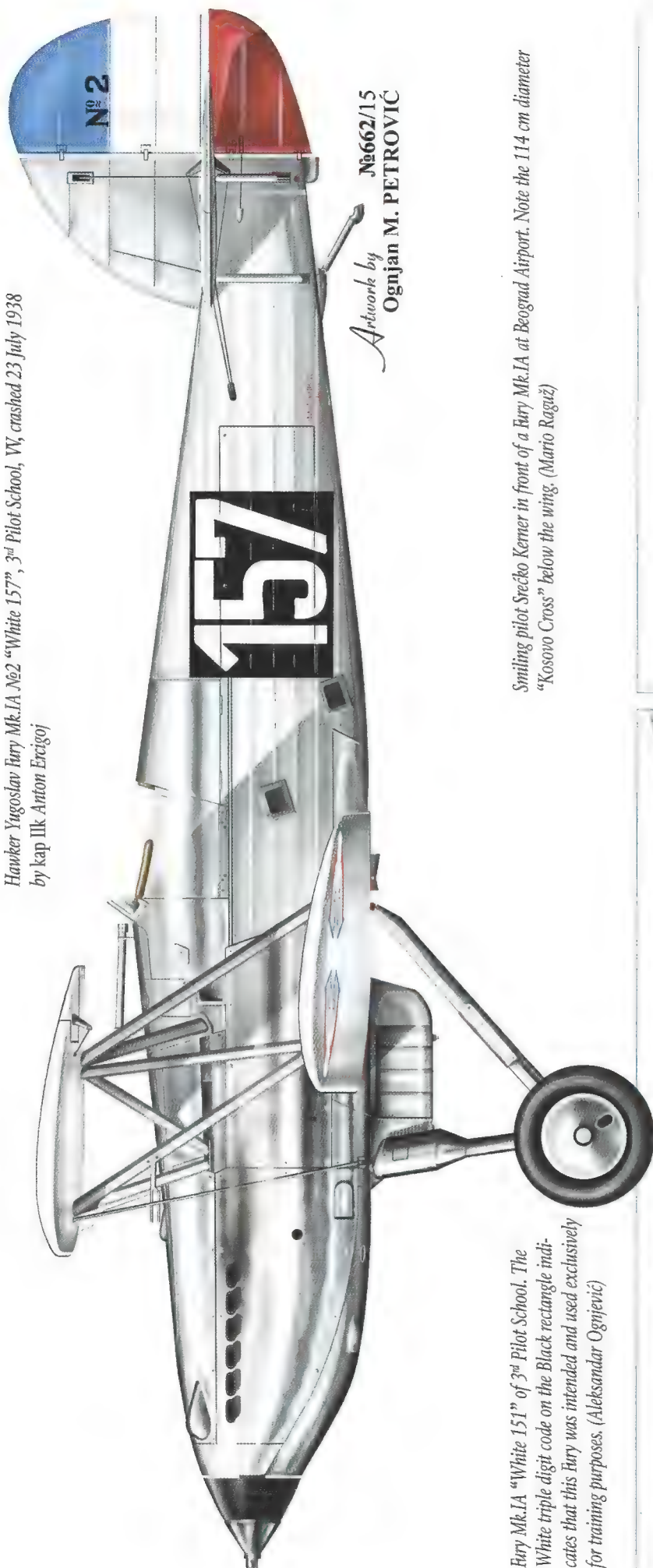


Fury Mk.IA №3 pictured in Brooklands prior to the delivery. Note bracing wires between cabane struts at the time. (Djordje Nikolić)

Hawker Fury Mk.IA №3 at Kraljevo Airport. Standard H-type cabane struts were placed instead of earlier bracing wires. Note "Black 3" on the White field on the rudder and non-visible (covered by wing in the photo) two-digit Black code on fuselage. (Milan Micevski)



Hawker Yugoslav Fury Mk.IA №2 "White 157", 3rd Pilot School, VW, crashed 23 July 1938
by kap Ilk Anton Erčigoj



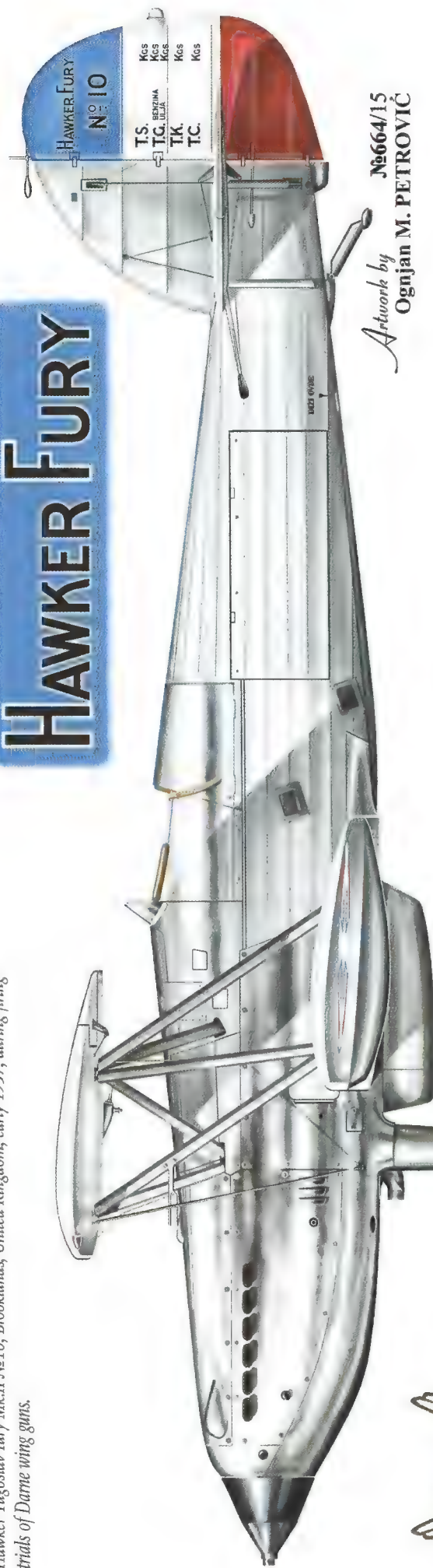
Fury Mk.IA "White 151" of 3rd Pilot School. The White triple digit code on the Black rectangle indicates that this Fury was intended and used exclusively for training purposes. (Aleksandar Ognjević)

Smiling pilot Srećko Kerner in front of a Fury Mk.IA at Beograd Airport. Note the 114 cm diameter "Kosovo Cross" below the wing. (Mario Raguz)



Hawker Yugoslav Fury Mk.II №10, Brooklands, United Kingdom, early 1937, during firing trials of Darne wing guns.

HAWKER FURY



Artwork by
Ognjan M. PETROVIĆ
№664/15

This photograph was taken in Brooklands during trials of a Yugoslav Fury Mk.II with two additional 7.7 mm M.30 (Saint-Etienne Darne) machine guns mounted under the lower wings. These machine guns were test fitted on two Fury fighters (№10 and №13), which were tested at Brooklands during the spring of 1937. Unfortunately, this solution did not prove well, hence it was never adopted. Note the removed gun fairing covers. (Djordje Nikolic)



The H.G. Hawker Engineering Co. Ltd. logo.



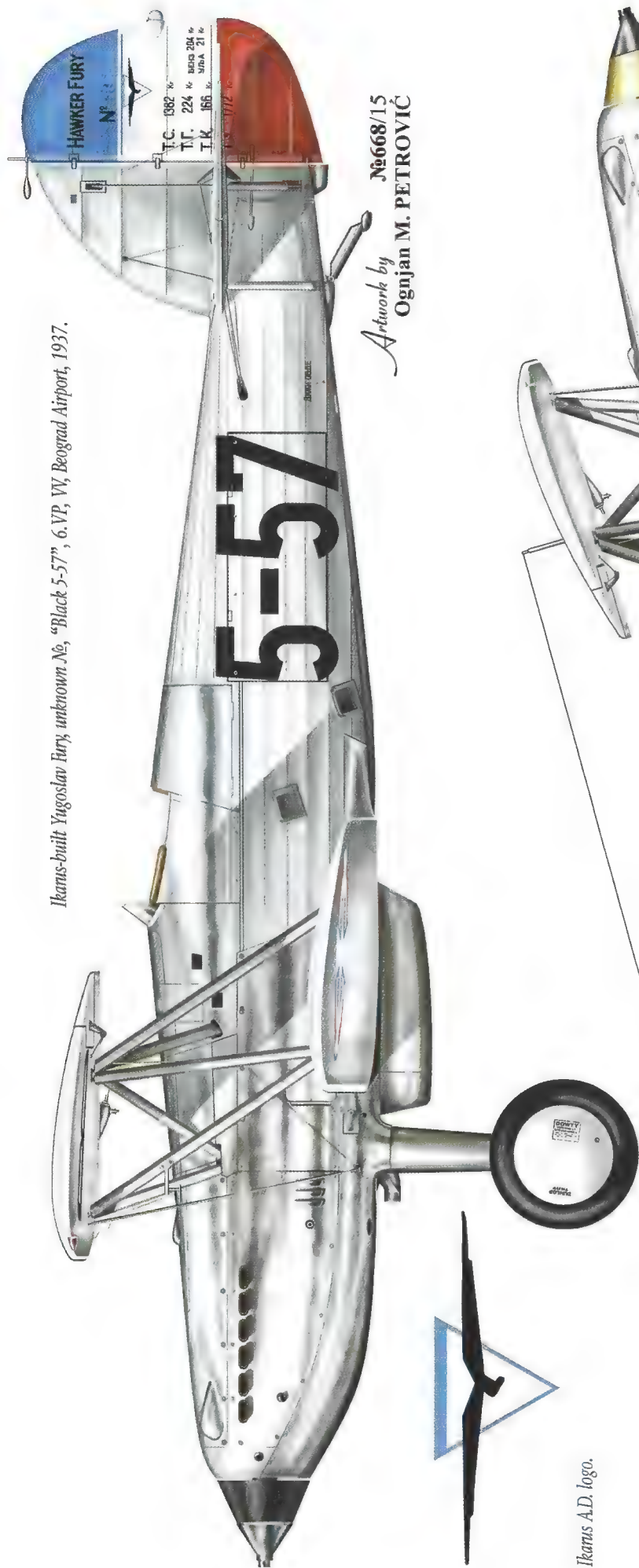
The Airscrew Co. Ltd. logo.



Rolls-Royce Ltd. logo.



Ikarus-built Yugoslav Fury, unknown №, "Black 5-57", 6.VP, VV, Beograd Airport, 1937.



Artwork by
Ognjan M. PETROVIĆ

Ikarus A.D. logo.

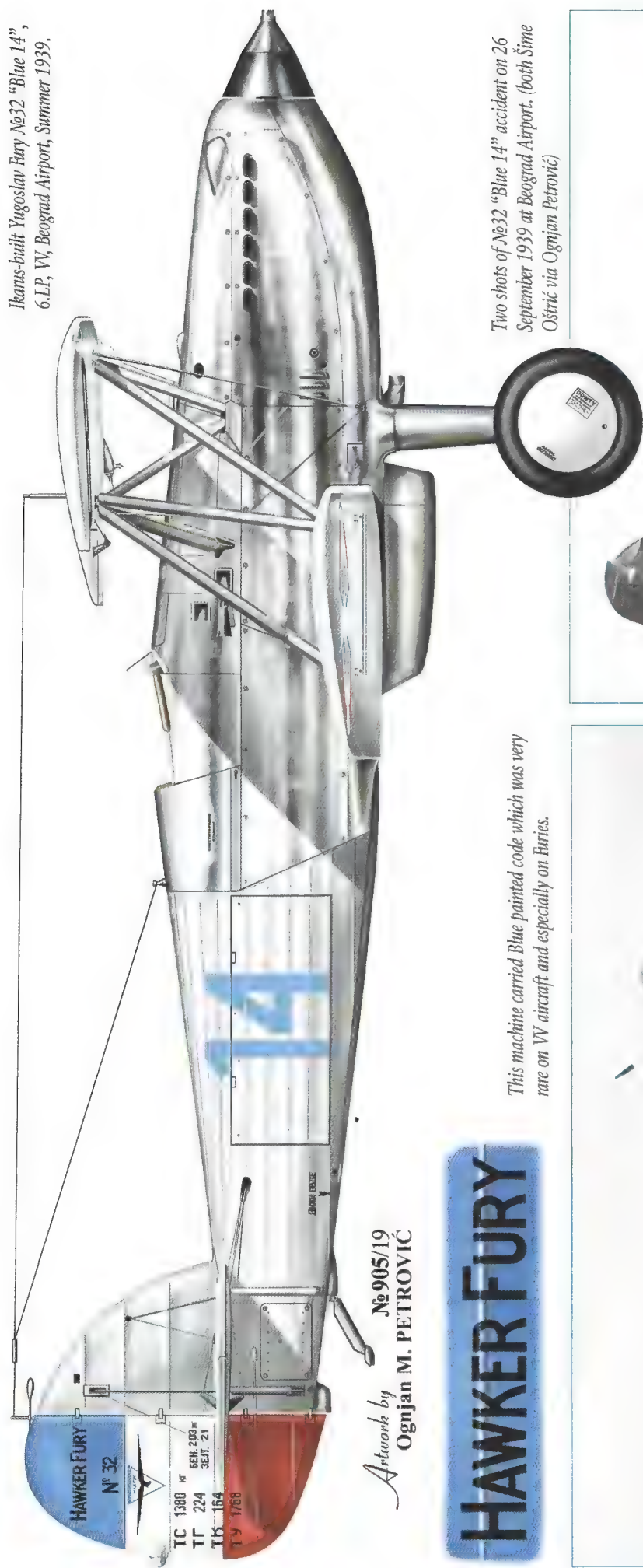


Zmaj-built Yugoslav Fury, unknown №, "Black 51", VOG, VV,
Beograd Airport, 1939, ski under-carriage trials.

Artwork by
Ognjan M. PETROVIĆ

Zmaj A.D. logo
with title.

Ikarus-built Yugoslav Fury №32 "Blue 14",
6.LP, VV, Beograd Airport, Summer 1939.



Two shots of №32 "Blue 14" accident on 26
September 1939 at Beograd Airport. (both Šime
Oštrić via Ognjan Petrović)

This machine carried Blue painted code which was very
rare on VV aircraft and especially on Furies.

HAWKER FURY





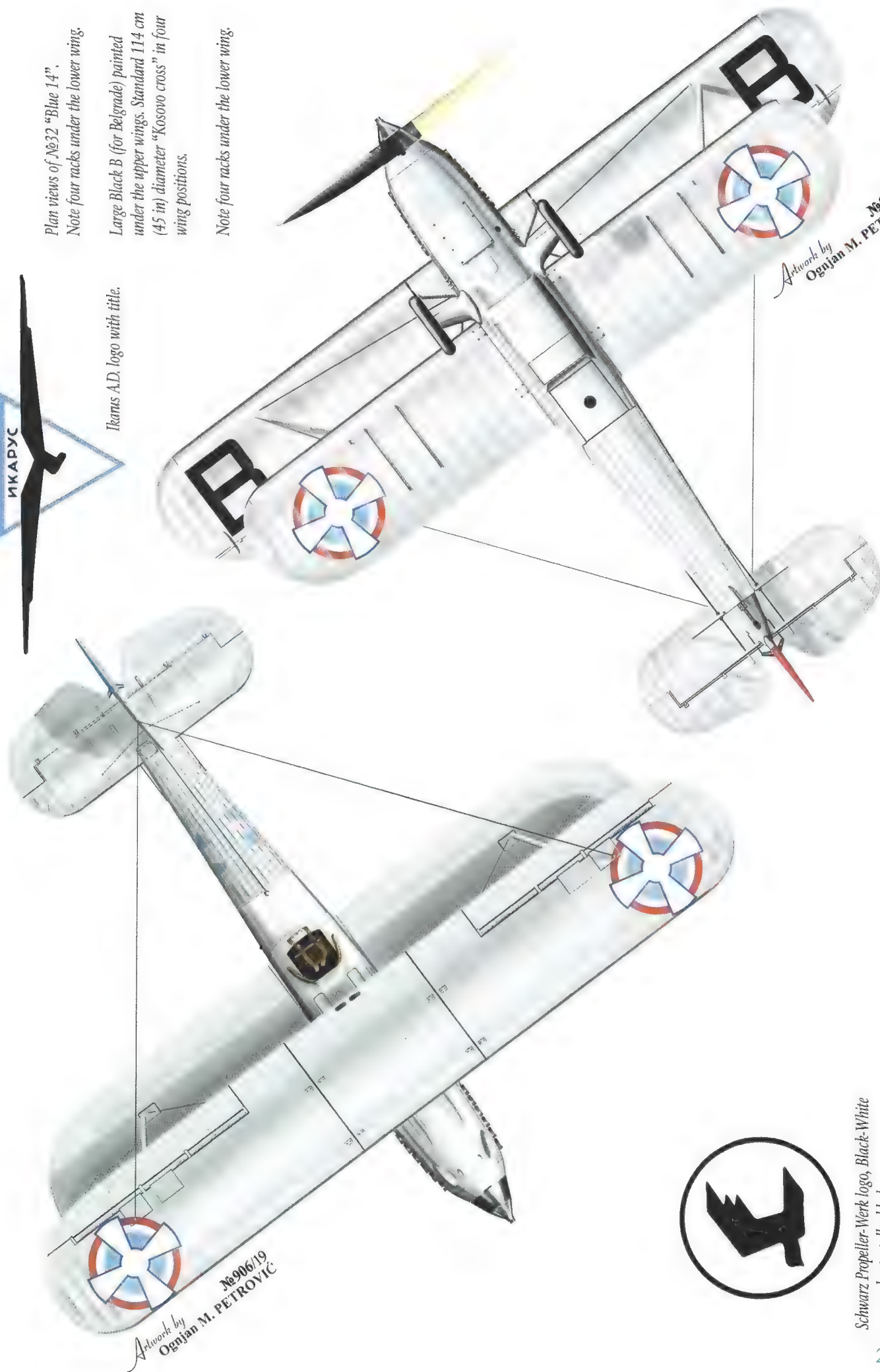
Ikarus AD, logo with title.

Plan views of №32 "Blue 14".
Note four racks under the lower wing.

Large Black B (for Belgrade) painted under the upper wings. Standard 114 cm (45 in) diameter "Kosovo cross" in four wing positions.

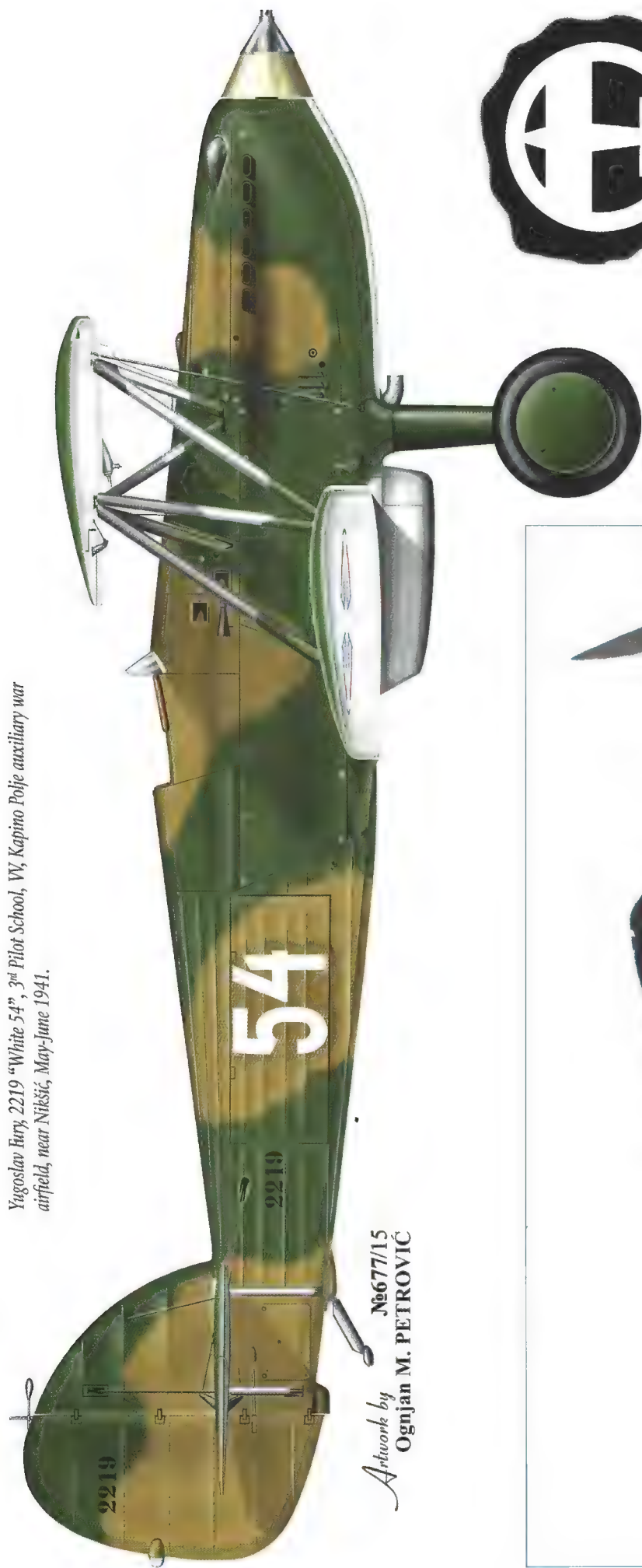
Note four racks under the lower wing.

Artwork by
Ognjan M. PETROVIĆ
№907/19



Schwarz Propeller-Werk logo, Black-White on wooden propeller blades.

Yugoslav Fury 2219 "White 54", 3rd Pilot School, VV, Kapino Polje auxiliary war airfield, near Nikšić, May-June 1941.



Rogožarski A.D. logo, White on Black propeller blades.



The Italians captured a total nine Furies with Escadrille numbers (codes): 10, 29, 41, 43, 44, 45, 46, 53 and 54. Fury EvBr 2219 "White 54" from 3rd Pilot School is shown here at Kapino Polje. Note *sm* 2219 applied in two positions, on the rudder and on the fuselage. (via Boris Ciglic)

Plan views of 2219 "White 54".



Newly introduced two-tone camouflage was applied on the upper surfaces of this machine, while the undersurface was left unchanged except the rear fuselage which was painted over in camouflage colours.



New asymmetrical VV national insignia is partially applied on "White 54". Small 65 cm diameter "Kosovo cross" was painted on the upper surface of the port upper wing, while two larger "Kosovo crosses" on the under surfaces of lower wings had 100 cm diameter. This was some kind of temporary manner of VV insignia with three "Kosovo crosses" instead of officially carried two.

Yugoslav Rury, 2248 "White 48", 5.L.P, VV, Šarlince village between Niš and Leskovac, auxiliary airfield. Summer 1940.



Pilot nar Ratomir "Rale" Milojević posing in front of his "White 48" at Šarlince auxiliary airfield. (Milan Micevski)



Different variation of camouflage patches and nonstandard position of the upper 100 cm diameter "Kosovo cross". Two underside insignias had the same diameter. Note the absence of s/n 2248 on the fuselage.

Ikarus IK-2

Background

Both the British and the French military attachés in KJ concluded in the late 1920s and early 1930s that in spite of being staffed with skilled officers, the VV lacked modern equipment, especially fighters. The inability of the domestic industry to satisfy the needs for re-equipment with modern fighters in sufficient quantities forced the government to look abroad for modern aircraft to renew its obsolete fleet.

At the time, the parasol wing fighter concept, first developed during World War I, became popular again with the development of Wibault 72, Loire-Gourdou-Lesseure LGL-32, Morane Saulnier MS-225, Dewoitine D.27 and D.37 in France and PWS-10 in Poland. As the next iteration of the parasol wing design, the so-called gull wing was developed and introduced first in the Polish P.Z.L. P1 fighter, designed by Żygmunt Pulawski in 1929. This was followed in 1930 by P.7, 1931 by P11 and 1933 by P.24. Soon, other countries began to develop aircraft using the high-wing design. One of the first companies to adopt the design was ANF Les Mureaux, which resulted in the development of Mureaux 170 and 180. Other companies followed, namely Czechoslovak Aero with its A-102, French Delanne prototype, Dewoitine D.560 and D.570, Gourdou-Lesseure GL-482, Loire Type 43, 45 and 46, German Henschel Hs-121 and Soviet Laville DI-4. On the other hand, opposite to the French and the Polish, the British favored the biplane designs until the appearance of the low wing monoplane fighters.

Designers Ljubomir Ilić (left) and Kosta Sivčev (right) worked after hours at Ilić's apartment and designed in secret the first entirely Yugoslav made fighter aircraft, the IK-L1. This photo of the two designers in front of their creation was taken in the spring of 1935. (Aviation Museum – Belgrade)



Development and prototypes

Despite the favored acquisitions abroad by the VV conservatives, in the early 1932 an idea to develop a modern combat aircraft was initiated by two young Serbian engineers, Ljubomir D. Ilić and Kosta I. Sivčev, who were at the time employed at the *Техничко одељење Команде Ваздухопловства* (Air Force Command Technical Department). Both engineers acquired their aeronautical education in France. Ljubomir Ilić graduated from the *École Nationale Supérieure de l'Aéronautique* (National Superior School of Aeronautics) in Paris whereas Kosta Sivčev worked both in French aircraft manufacturer's design bureaus and at the *Armée de l'Air* (French Air Force) *Centre d'Essai du Matériel Aérien* (Air Equipment Test Center) at Villacoublay. At this time, Rogožarski P.V.T. fighter-trainer type, successfully pushed out the French competitors and enabled the domestic industry to take the lead in manufacturing training aircraft. Thankfully, the vision of these two young engineers enabled the domestic industry to become one of the most important sources of supply for combat aircraft to the VV in the years to come.

Ljubomir Ilić and Kosta Sivčev worked after hours at Ilić's apartment and designed in secret the first entirely Yugoslav made fighter aircraft, the IK-1L. The IK-1L was a high wing monoplane with fixed landing gear and a metal frame structure covered with fabric. It was powered by a new 12 cylinder Vee liquid-cooled 860 mhp Hispano Suiza 12Ycrs engine with gear and supercharger, the so called *mo-teur-canon*, which was the only engine of its time to incorporate centrally mounted cannon. Pre-project, basic aerodynamic and other necessary evaluation work was completed by the early 1933. The designers prepared an accurate wooden scale model and Ilić went to Paris at his own expense to perform testing on this model at the wind tunnel created by Gustave Eiffel in 1911. The original records from the wind tunnel show that the model was assigned designation I.K Type L1 and was tested on 21 June 1933. After extensive testing and aerodynamic improvements, the engineers created detailed technical drawings.

The engineers eventually revealed their design and the existence of their private venture to their chief, engineer Srbobran M. Stanojević who was in charge of the Technical Department. After the initial surprise, he gave his approval, indicating his delight at the detailed drawings and promised all possible support for the project. Soon on 22 September 1933 a report proposing the construction of the new fighter was presented to the senior VV officers. They were skeptical of the monoplane design having only had experience with biplanes previously. In spite of the opposition, owing to engineer Stanojević's support, the prototype was finally ordered in the early 1934 and was completed in September by Ikarus. Following extensive wing static testing and necessary modifications, the permission was granted to make the first flight. The first flight took place on 22 April 1935, with no armament and partial fuel load. The aircraft crashed on its third flight with *kap Ik* Leonid I. Bajdak at the controls due to a manufacturing error in the fabric application to the wing. Additionally, it was determined that *kap Ik* Bajdak exceeded the permitted loading while maneuvering the aircraft. Ironically he was one of the main critics of the design.

After 10 months, the Ikarus factory began work on the second prototype which had its first flight on 24 August 1936 with pilot *ppor* Janko A. Dobnikar at the controls. The vertical stabilizer was marked I.K. No 02, again in accordance with the French-type designation system. The aircraft was known as I.K.02 or IK-02. The second prototype had metal covered wings, a more streamline fuselage, smaller radiator, modified air intakes and other improvements. The aircraft underwent rigorous testing in the newly formed VOG. In the middle of October 1936, it attained a speed of 435 km/h, which was more

This photo was taken at an early stage of official tests, without armament and with streamlined wheel spats. All metal parts were left in natural polished aluminum while fabric parts were painted in Silver dope. A Yugoslav tri-colour flag was applied across the entire rudder surface. Black inscriptions on the flag are applied for the aircraft type, c/n and engine type. (1936 Yugoslav Aviation Yearbook)





Early shots of IK-L1 during tests with wheel spats removed, April 1935. (Aviation Museum – Belgrade)



The second prototype was completed on 24 August 1936. This photograph was taken during its trials at VOG between 1936 and 1937. Note that the wheel spats are removed. (Milan Micevski)



The second prototype Ikarus IK No. 02 at VOG apron, October 1936. Hub-firing cannon appeared for the first time. Note the personal signature of the test pilot Dobnikar (Janko Dobnikar family via Predrag Miladinović)

than the calculated 415 km/h. At the time this was the unofficial European record for aircraft with fixed landing gear. Testing was concluded in November of the same year and the official report was handed off for review in May 1937.

The performance of IK-02 exceeded, at the time, that of the most modern biplane fighter, Hawker Fury, which was manufactured under license at the Ikarus and Zmaj factories. The critic of the aircraft, *kap Ik Bajdak*, having survived the crash, was challenged by the new VOG test pilot *por Janko A. Dobnikar* to a duel in three categories: a climb to 4,000 meters, a 140 km race from Belgrade to Novi Sad and back and simulated dogfights over the Beograd Airport. The IK-02 won the first round, as it reached the target altitude faster than the Hawker Fury piloted by *kap Ik Bajdak*. In the next round, the two machines set off on a race that was again won by the IK-02. In the third round, during the course of 16 simulated dogfights between 13 and 24 June 1937, the IK-02 came out as an absolute winner in each and every one. To make the evaluation fair, the same pilots interchanged between IK-02 and Hawker Fury. To summarize, the IK-02 proved superior in every aspect; with higher speed, better manoeuvrability and heavier armament, something not even the conservative critics within VV could deny.

During the First international aviation exhibit in Belgrade held between 29 May and 13 June 1938, the second prototype, re-designated as IK-2 and with new s/n Br.01 (i.e. Br.1 as the first machine of planned series), was displayed at Ikarus pavilion and it attracted curious onlookers, both foreign and domestic.

IK-2 series production

The permission to commence the construction of the 12 first batch aircraft, officially known as the IK-2, was given on 20 November 1937 and already the next month the order was placed with Ikarus factory. The IK-2s completed at the factory lacked armament and radio equipment; hence these had to be installed at the VV workshops (according to standardized VV practice). The armament consisted of one hub-firing 20 mm Hispano Suiza 9 cannon and two synchronized 7.7 mm M.30 (Darne Modèle 1930) machine guns above the engine. Gun sight was Teleoptik Collimateur Chretien E.T.Aé Modèle 1933. The radio equipment consisted of German made Telefunken FuG VII radio station, the same type used in the Yugoslav Bf 109E-3a fighters. For winter operations, the aircraft could be equipped with skis. Contrary to the prototypes, which used the original Hispano Suiza engines manufactured in France, the series aircraft used license built Czechoslovakian Avia HS 12Ycrs.

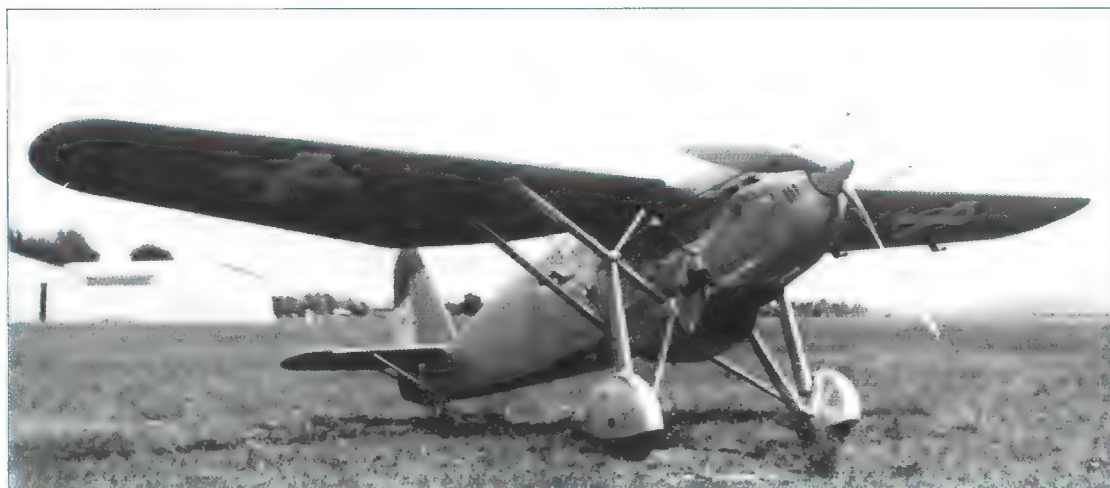
The IK-2, single-seat cannon-armed, all-metal strut-braced shoulder-wing fighter monoplane with rather cumbersome fixed undercarriage, was the first Yugoslav indigenous designed and domestic built fighter, the first nationally-built high-wing monoplane and the first fighter with cannon. Officially VV classification from the mid 1940 was „једномоторни авион једносед за борбу са мотором Hispano-Suiza 12Ycrs од 860 КС на висини искоришћења 3100 метара“ (single-engine single-seat combat aircraft with 860 mhp Hispano Suiza 12Ycrs at 3,100 m exploitation altitude). The life span of the engine was 1,500h with 4 major overhauls.

From the middle of October and the first days in December 1938, the first six IK-2 machines made their first flights and by the end of February of next year, so did the remainder. The last aircraft, Br.13 (№13), flew over to Beograd Airport on 25 February 1939. All machines were tested by the new factory test pilot *kap IIIk* Vasilije J. Stojanović. The entire first or zero series was assigned to the elite 6.LP defending the capital city, Belgrade. By the first half of 1939, they became fully operational. In October 1939, all IK-2s were transferred to 4. LP at Zagreb, as a stop gap solution until the new Hawker Hurricanes arrived. Thereafter, it was planned that the IK-2s and the Hawker Furies equip the 5.LP based at Niš. By the end of 1940, all IK-2 fighters were concentrated at the 34.VG within the 107. *Escadrille*. While Hawker Furies transferred to Niš, the IK-2s remained with 4.LP even when the Hurricanes began to arrive. On 1 January 1940 VV had 12 IK-2s on strength of which nine were operational and three were inoperable and in need of servicing. During the operational use, the second IK-2 prototype was destroyed in June 1940 while flying in a storm over Zemun with fortunate outcome for test pilot *kap IIIk* Milan V. Bjelanović who successfully bailed out.

It was planned to build a two-seat training version with dual controls, however this ended as a project only when it became obvious that high wing monoplane designs were becoming hopelessly obsolete and no further orders for IK-2 were placed.

According to its conception, armament, engine power and technology of manufacture, the IK-2 was at the very top of the world class aircraft designs in the first half of the 1930s. This early appearance of IK-2 was not used in the best manner. Several precious years were lost due to the unnecessary delays, IK-2 could have been modern and suitable for front line service had it joined VV service earlier, displacing the biplanes, which otherwise had to be kept in service. As a result, instead of being armed with

IK №02 at Beograd Airport most likely in late 1936. The aircraft was marked in accordance with the standard practice of the time with four 120 cm diameter “Kosovo Cross” insignia on both the wing topsides and undersides. (Miloš Milosavljević)





IK-2s, VV purchased Hawker Furies and ordered their license manufacturing domestically. This was considered a step backward since major aeronautical powers already began designing monoplanes at the time. Apart from conservative opinions within the VV, this decision to delay IK-2 introduction was also a result of poor financial situation at the time. It was questionable if the domestic aviation industry was able at the time to quickly begin and complete production of all metal high wing monoplanes.

On the other hand, it must be considered that had the series production began earlier, VV would have most likely entered the war with obsolete aircraft as there would be no capacity left for the development and license production of more modern aircraft such as the Rogožarski IK-3 and the Hawker Hurricane Mk.I, and, of course, also importing modern German Messerschmitt Bf 109E-3a fighter.

IK-2 goes to war

Despite excellent performance, the fixed landing gear and the high wing structure, IK-2 could not keep pace with the latest aerodynamics achievements and as a result it became obsolete even before officially entering service. At the time of the German attack, on 6 April 1941, VV could rely on eight IK-2s within 34.VG 107.E under the command of *kap Ik* Žarko M. Vukajlović. Two (EvBr 2103 and 2113) were undergoing repairs at and two were at the repair shops at Zagreb Airport.

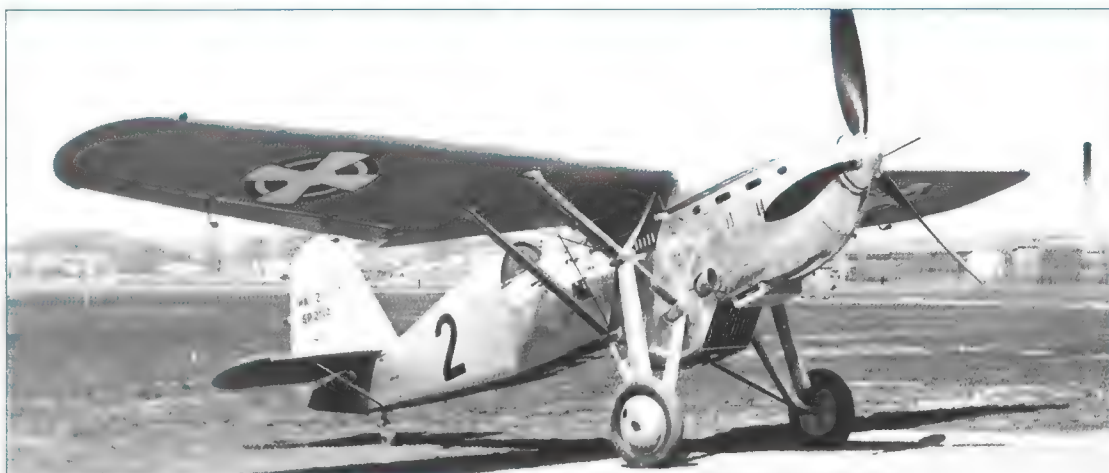
The first war patrols took place already in the afternoon of 6 April when a pair of the 107.E active IK-2s were assigned protection of Bristol Blenheim bombers belonging to 8.BP and as a result flew over to Rovine airfield, war base of 8.BP. These patrols continued the next day with IK-2s flying in designated point defence sectors due to their short operational range. That afternoon became the ultimate day for the IK-2 wartime use. Flying at extremely low altitude, a group of 27 Messerschmitt Bf 109E-4/7s from *Luftwaffe's* JG54 „Grünherz“ came across Rovine airfield. One IK-2 with *pnar Ik* Branko Jovanović at the controls (who had just landed) took off immediately and entered combat with a formation of nine Messerschmitts. Aware of his fighter's excellent maneuverability, he was able to evade the pursuing German fighters until help arrived. Five other IK-2s, which were on combat alert with warmed up engines, took off from Bosanski Aleksandrovac airfield. A total of 10 VV fighters faced 27 *Luftwaffe* fighters over these two locations. The outcome of the battle was two Hurricanes and one IK-2 shot down, as well as a German Bf 109. On 8 April, seven IK-2s left at Bosanski Aleksandrovac airfield were conducting regular patrols over Bosnia. Of those, one aircraft had emergency landing and flipped over on its back. This marked the end of the VV IK-2 wartime use. At the end of the war two IK-2s were captured by *Wehr-*

Ikarus IK-2 BR01, ex-second prototype IK №02 was exhibited at the First International Aeronautical Exhibition held in Belgrade between 28 May and 13 June 1938: (top left) arm đen Ljubomir Marić, Army and Navy minister (in military uniform) and engineer Emilo Matić, IAM concern director (in White topcoat) inspecting IK-2 (Nenad Miklušev); (the rest of the photos) three rare shots of the presented machine (Alex Imrie via Nenad Miklušev). Note the highly polished aluminum section of the aircraft and wheel spats which were later removed.

Series IK-2 BR.2109 from 6.LP pictured in February 1939 at Beograd Airport. Canopy cover was removed, some pilots preferred to fly with open canopy due to the poor visibility on landing. Note that the hub-firing cannon can be seen on BR.2109. (Janko Dobnikar family via Predrag Miladinović)



This is a fine shot of IK-2 BR.2110 "Black 2" from the capital's 6.LP, Beograd Airport, September 1939. During early service years in the VV, the IK-2 fighters were marked with large Black Escadrille numbers 50 cm tall, which were not analogous to the serial numbers. Note the absence of hub-firing cannon. (Aviation Museum – Belgrade)



macht troops while at overhaul at Ikarus A.D. and one was captured at Bosanski Aleksandrovac airfield, while numerous others were deliberately set on fire, including the one at Veliki Radinci auxiliary airfield, which was flown over on 7 April to 51.VG. The captured aircraft were refurbished and completed following the end of hostilities at the Ikarus A. D. and a total of four (VV s/nos 2103, 2106, 2111, 2113) were handed over to newly-formed *Zrakoplovstvo Nezavisne Države Hrvatske* (ZNDH – Independent State of Croatia Air Force) with new s/nos 2901–2904.

Camouflage and Markings

Type designations

Official VV designation was IK-2, although the type was also known as Ika-2, Ika 2 and IK-2C (C – Chasseur – fighter).

Construction and serial numbers

The first prototype had c/n 01 (according to the French manner), the second prototype became c/n 1 and serial machines c/n 2-13. Prototypes had s/nos Br.01 and Br.02 while BP.01 and №2 were painted on Blue field on the rudder flag.

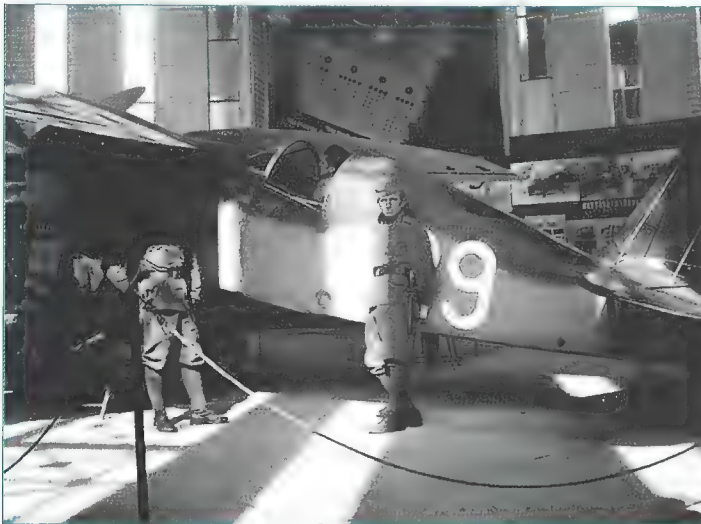
In service, series aircraft were allotted s/nos №2 through №13 and in 1940 they were re-numbered BR.2101 for the prototype and BR.2102-2113 for the series aircraft. These numbers were painted on Blue field on the flag. Following the introduction of the three tone camouflage scheme, c/nos were applied in the form of №2101 to №2113.

Codes and inscriptions

Initially, the IK-2s were marked with large Black 50 cm tall *Escadrille* numbers which were analogous to the serial numbers. From 1940s, according to the reconstructions, the IK-2s carried White *Escadrille* numbers while in service with 4.LP. Stencils, such as the engine type were written in Latin alphabet on



By the end of 1940, all IK-2 fighters were concentrated at the 34.VG within the 107. Escadrille. Here, ground crews pose in front of the newly camouflaged №2107 "White 31" and №2110 "White 34" (ex "Black 2") in one of the hangars belonging to 4.LP at Zagreb Airport. Note the small White number 2107 on the oilcloth propeller blades and the lack of cannon. (Dragan Kolundžić)



Two shots of camouflaged IK-2 №2105 "White 29" from 4.LP displayed at the Technical Exhibition in the French Pavilion at Zagreb Fair, 1940 (both Robert Čopce).



IK-2 BR.2104 rests on its nose following a minor mishap during landing at a soaked Zagreb Airport. The aircraft wears a new camouflage scheme which consisted of irregular patches in three colours. On the top side of the port wing a 60 cm diameter "Kosovo cross" is visible. Note the hub-firing cannon is installed. The tail light has been relocated to a lower position. (Šime Oštrić via Ognjan Petrović)



Three fighter pilots from 107.E pictured at Krško auxiliary airfield, June 1940: (left) kap Ik Žarko Vukajlović, the unit's CO; (mid) nar Radivoje Stikić; nar Lazar Vukobratović. Note that the same machine, without cannon, is in all photographs. (all, Šime Oštrić via Ognjan Petrović)

A total of three IK-2s were captured by German forces at the end of April War. Here, an unknown IK-2 from 34.VG 107.E rests at Bosanski Aleksandrovac airfield with a Wehrmacht officer posing in the front. Note the unusual camouflage with the absence of light Blue-Grey on the undersides. (Djordje Nikolić)



the rudder White surfaces and directly above the Ikarus factory logo. Series aircraft had a cautionary „ДИЖКИ ОВДЕ“ (lift here) written at the sides of aft fuselage to designate the lifting point for maintenance. In accordance with the practices from 1930s, the first letter of the base airport was painted below the wings. IK-2 was no exception, as during service with 4.LP while still without new camouflage scheme, a large letter Z, for Zagreb, was applied. Camouflage painted aircraft had only a small flag on the rudder and a small Black factory logo.



The same machine clearly shows two large “Kosovo crosses” on both wing undersurfaces. (Nenad Jovanović via Aleksandar Ognjević)

National insignia

Before the war, the IK-2 carried four standard 120 cm diameter “Kosovo cross” insignia on both the wing topsides and undersides. A Yugoslav tri-colour flag was applied across the entire rudder surface on the prototypes while on the series aircraft it was applied on the rudder except the very top.

With the introduction of the new aircraft markings regulations, national insignia placement and camouflage painting for all VV aircraft were changed. The IK-2s were painted over with the new camouflage scheme while retaining the insignia in four positions. Small 30 cm tall tail stripes in form of Yugoslav state flag (so-called war flag) were applied on the rudder. Later, with the introduction of the so-called asymmetrical markings system, the “Kosovo cross” was intended to be applied in only two positions, at the top side of the port wing measuring 60 cm in diameter and on the bottom side of the starboard wing measuring 120 cm in diameter. In spite of the regulations calling for such markings, similar to other VV aircraft types, it was common to see two older style large markings retained below the wings.

Colour schemes

While in service with the VV, the IK-2 carried two colour schemes. The first, overall Silver, was used on all VV fighters until 1939. Specifically, all metal parts were left in natural polished Aluminum colour while fabric was painted with Aluminum dope Silver colour. On the IK-2 prototypes, the propellers were Silver at the front and Black at the rear side while series aircraft propellers were either entirely Black or Light Blue Grey. The second colour scheme consisted of irregular patches in three colours. According to the new VV regulations, aircraft which included the IK-2 were painted on the topsides with Ochre Yellow, Dark Green and Dark Brown. The were painted with Light Blue Grey. Of course, during the change from one to the next camouflage, a number of variations deviating from the recommended practices were known to exist.

| IK-2 designations, c/nos and s/nos | | | | | | |
|------------------------------------|-----|-------------|----------------|-----------------|-----------------|----------------------|
| Type | c/n | № (1938) | EvBr (1940) | Code* (1939) | Code* (1941) | Note |
| IK-L1 | 01 | Br. 01 | - | - | - | Destroyed April 1935 |
| IK-02 | 1 | Br. 02 | 2101 | - | - | Destroyed June 1940 |
| IK-2 | 2 | №2 | 2102 | - | - | - |
| IK-2 | 3 | №3 | 2103 | - | - | Captured by Germans |
| IK-2 | 4 | №4 | 2104 | - | - | - |
| IK-2 | 5 | №5 | 2105 | - | “White 29” | - |
| IK-2 | 6 | №6 | 2106 | - | - | Captured by Croats |
| IK-2 | 7 | №7 | 2107 | - | “White 31” | - |
| IK-2 | 8 | №8 | 2108 | - | - | - |
| IK-2 | 9 | №9 | 2109 | “Black 1” | - | - |
| IK-2 | 10 | №10 | 2110 | “Black 2” | “White 34” | - |
| IK-2 | 11 | №11 | 2111 | “Black 3” | - | Captured by Germans |
| IK-2 | 12 | №12 | 2112 | “Black 4” | - | - |
| IK-2 | 13 | №13 | 2113 | “Black 5” | - | Captured by Germans |

* Known codes

| Aircraft Characteristics Ikarus IK-L1 Prototype | |
|---|--|
| Quantity used: | One |
| Crew: | 1 |
| Years of Service: | 1935 |
| Span: | 11.2 m (36.8 ft) |
| Length: | 7.9 m (25.9 ft) |
| Height: | 3.8 m (12.6 ft) |
| Wing area: | 18.0 m ² (194 ft ²) |
| Engine: | One 860 mhp (848 hp) Hispano-Suiza 12Ycrs |
| Empty weight: | 1,440 kg (3,174 lb) |
| Loaded weight: | 1,650 kg (3,636 lb) |
| Armament: | None |

| Aircraft Characteristics Ikarus IK-02 Prototype | |
|---|--|
| Quantity used: | One |
| Crew: | 1 |
| Years of Service: | 1936-1940 |
| Span: | 11.2 m (36.8 ft) |
| Length: | 7.9 m (25.9 ft) |
| Height: | 3.8 m (12.6 ft) |
| Wing area: | 18.0 m ² (194 ft ²) |
| Engine: | One 860 mhp (848 hp) Hispano-Suiza 12Ycrs |
| Empty weight: | 1,502 kg (3,312 lb) |
| Loaded weight: | 1,875 kg (4,134 lb) |
| Maximum speed: | 435 km/h (270 mph) at 3,000 m (9,843 ft) |
| Service ceiling: | 12,000 m (40,028 ft) |
| Climb to 3,000 m: | 5 min 25 s |
| Range: | 700 km (435 ml) |
| Armament: | Originally two synchronized 7,7 mm M.30 (Darne), later replaced with two 7,92 mm M.38 (FN Browning) machine guns, one hub-firing 20 mm Hispano Suiza S9 cannon, sometimes replaced with M.38 |

| Aircraft Characteristics Ikarus IK-2 Series production | |
|--|--|
| Quantity used: | 12 |
| Crew: | 1 |
| Years of Service: | 1938-1941 |
| Engine: | One Avia-built 860 mhp (848 hp) Hispano-Suiza 12Ycrs |
| Note: | Other characteristics are the same as on IK-02 Prototype |

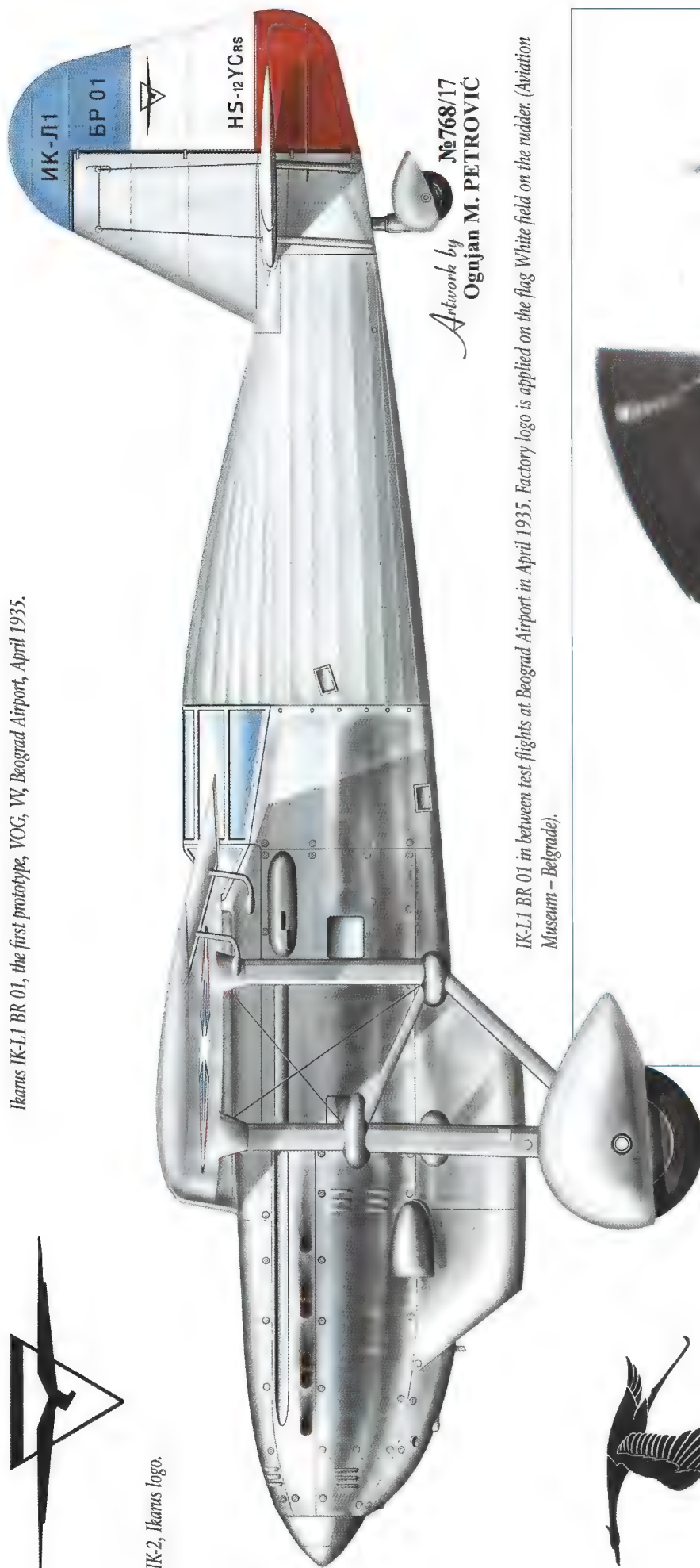
Burnt IK-2 at Veliki Radinci auxiliary war airfield. This machine was flown from the Ikarus factory to 51.VG on 7 April 1941. Note the hub-firing M.38 machine gun on this machine. (Jan van den Heuvel via Aleksandar Ognjević)





IK-2, Ikarus logo.

Ikarus IK-L1 BR 01, the first prototype, VOG, W, Beograd Airport, April 1935.



*Artwork by
Ognjan M. PETROVIĆ*

IK-L1 BR 01 in between test flights at Beograd Airport in April 1935. Factory logo is applied on the flag White field on the rudder. (Aviation Museum – Belgrade).

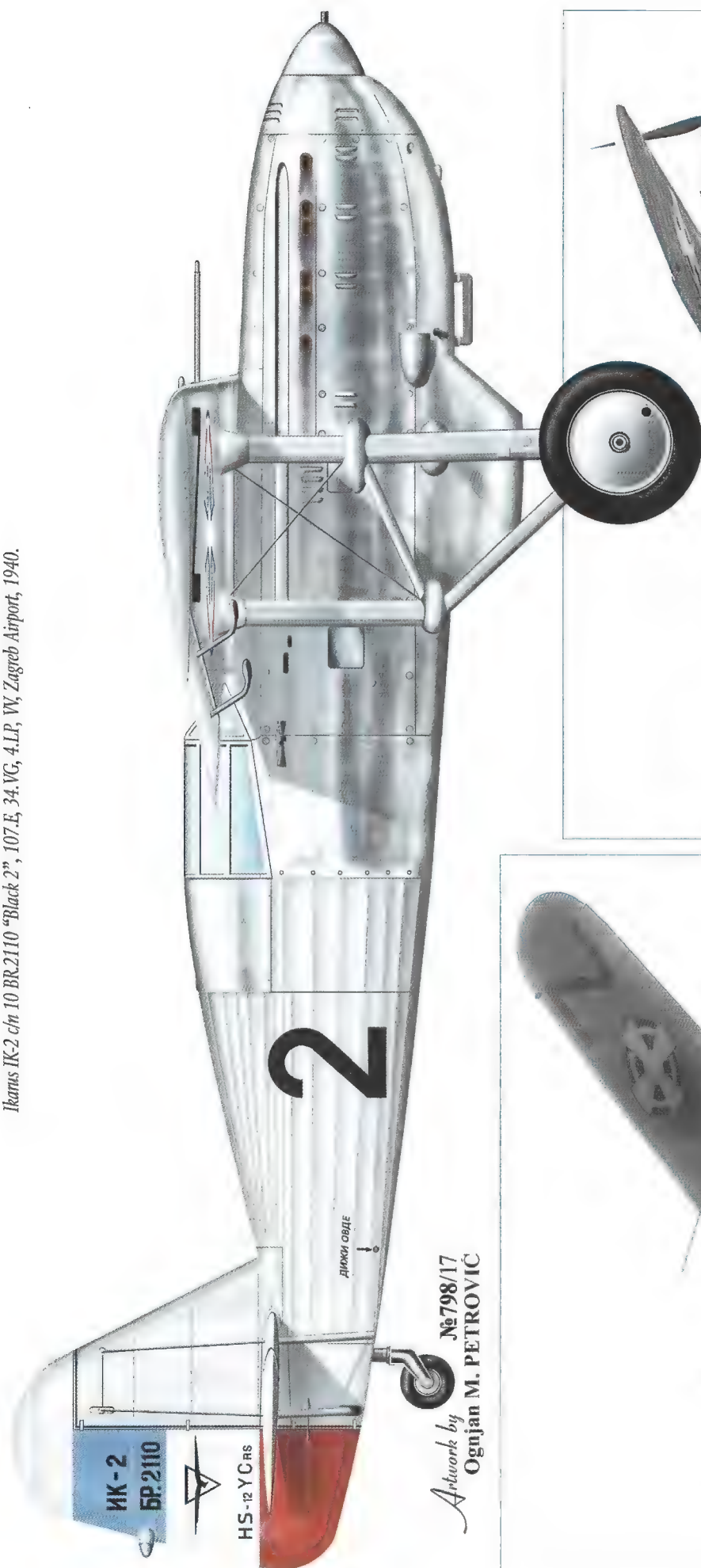


IK-2, Hispano-Suiza logo.



IK-2, Avia logo.



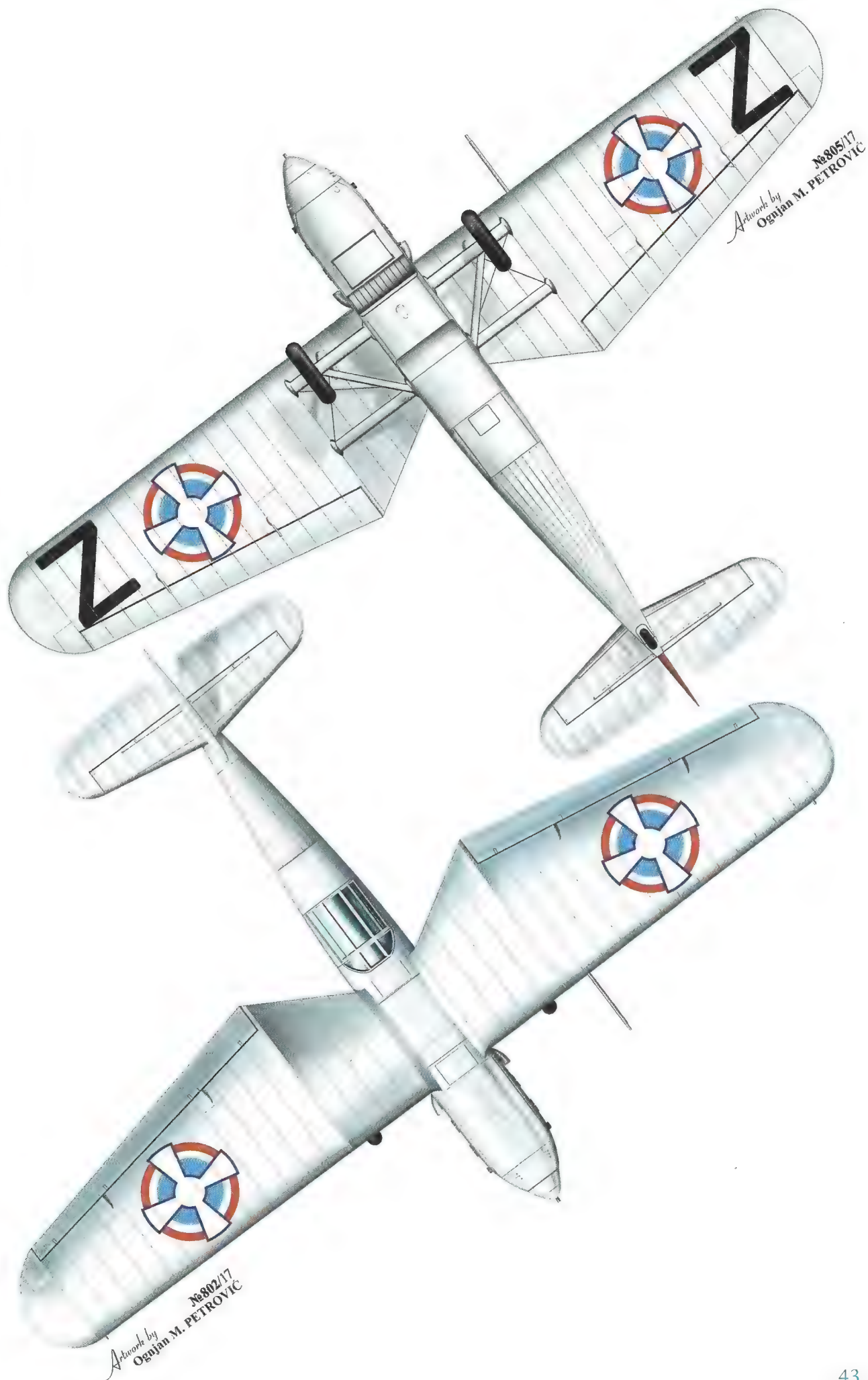


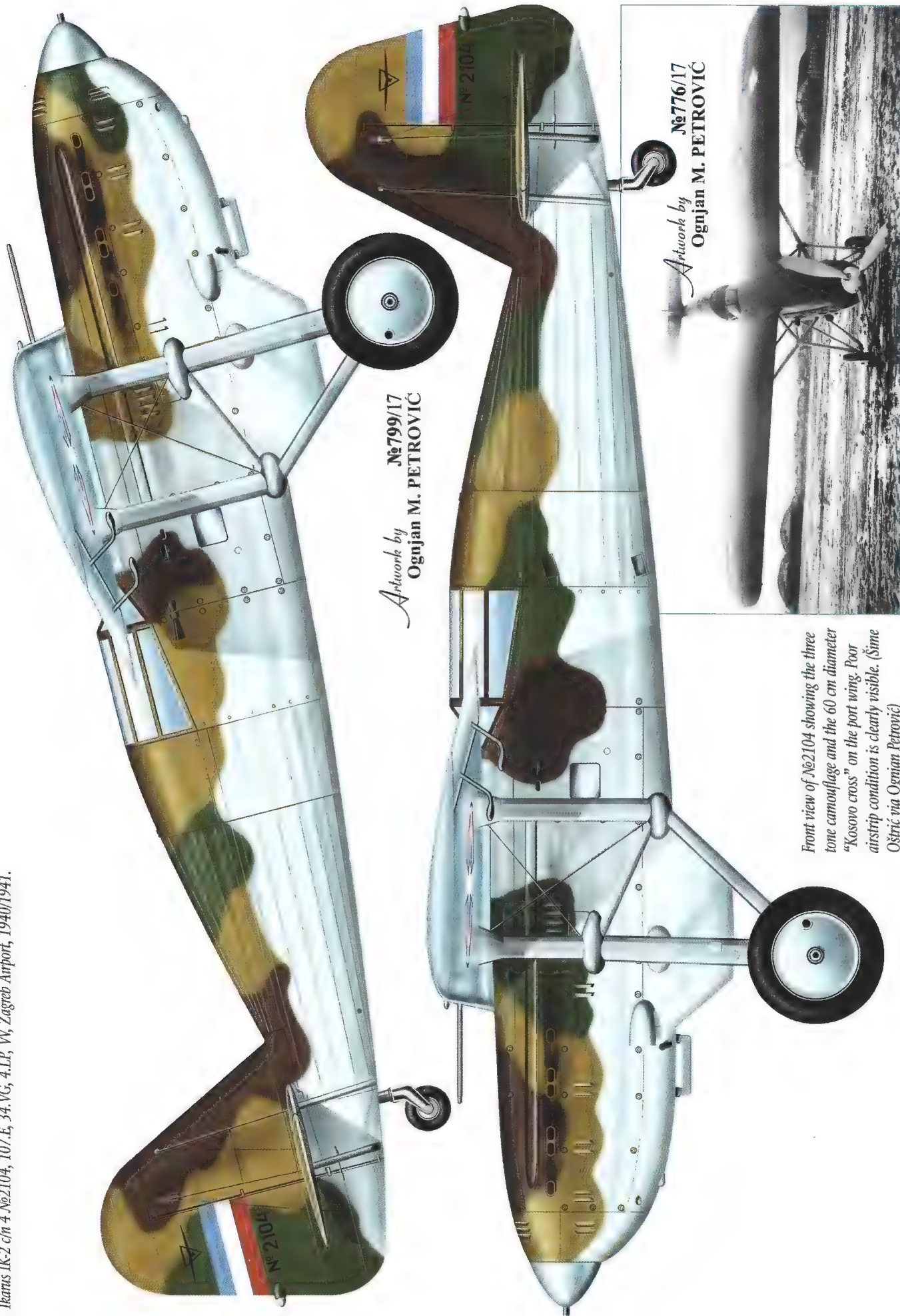
IK-2 BR.2110 "Black 2" suffered a landing accident at Zagreb Airport with the starboard landing gear strut collapsing. Note the large Black letter Z beneath the wing which indicates that this photo was taken after October 1939, when all IK-2s were transferred to 4.LP at Zagreb, as a stop gap solution until the new Hawker Hurricanes arrived. (Djordje Nikolic)



Side view of BR.2110 during mid 1939. This shot offers a good view of the distinct demarcation between the natural aluminium and fabric surfaces. Apart from the aircraft designation and the c/n, the rudder also carries the Ikarus factory logo as well as the engine designation. (Aviation Museum – Belgrade)

Plan views of Ikarus BR.2110, 4.L.P., VV, Zagreb Airport. Before the war, series IK-2s carried four standard 120 cm diameter "Kosovo Cross" insignia in four wing positions.





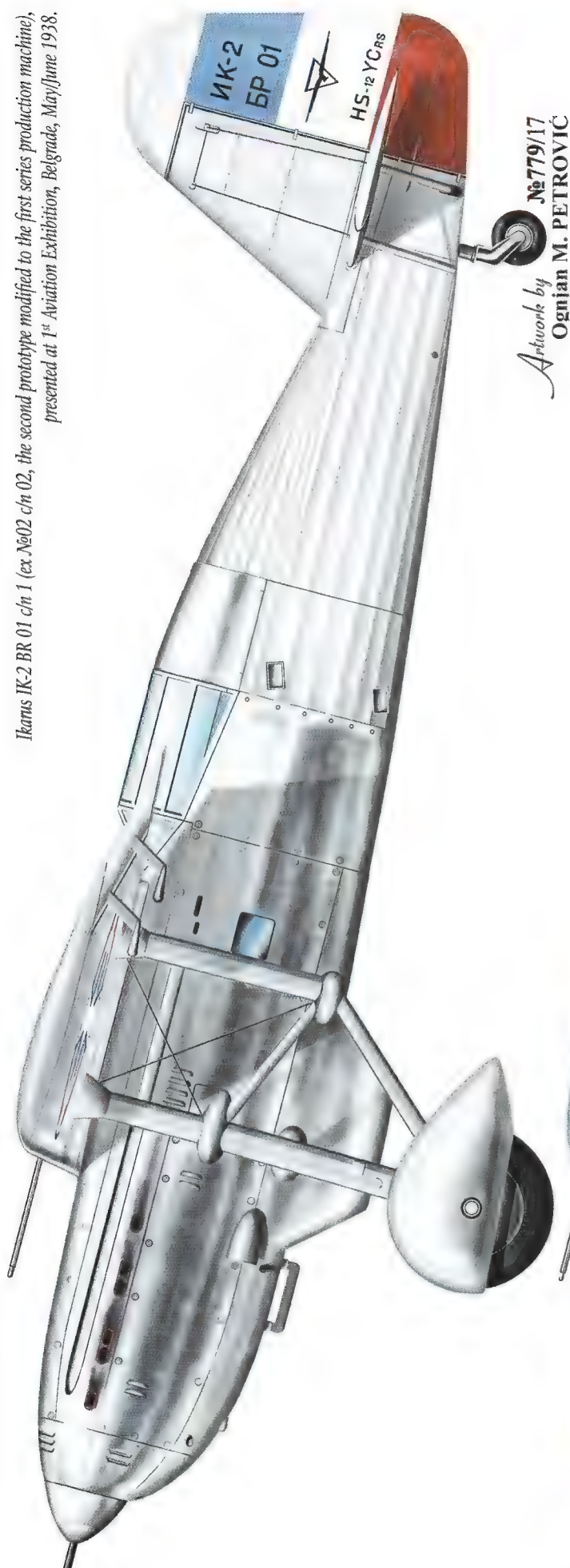
Front view of №2104 showing the three tone camouflage and the 60 cm diameter "Kosovo cross" on the port wing. Poor airstrip condition is clearly visible. (Šime Oštrić via Ognjan Petrović)



Upper and lower views of №2104 with the newly adopted VV three-tone camouflage scheme. With the implementation of this wartime camouflage, the undersides and the propellers were painted with Light Blue Grey colour. The size of the insignia beneath the wings was retained. The upper side "Kosovo cross" on the starboard wing was reduced to 60 cm diameter.

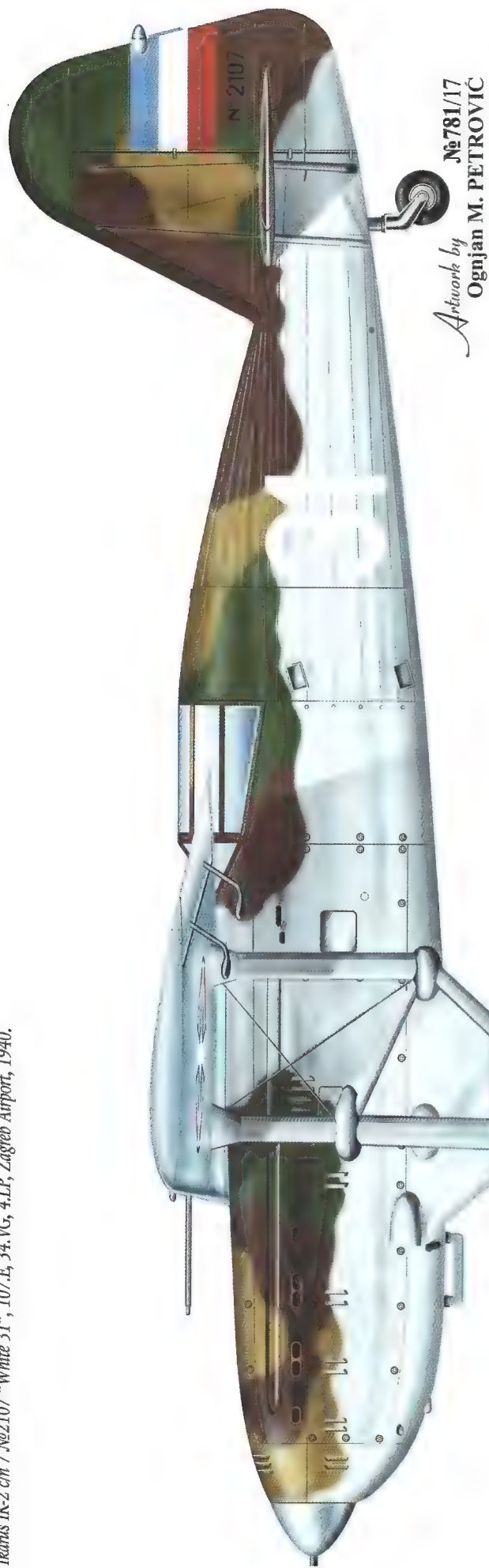


Ikamc IK-2 BR 01 c/n 1 (ex №02 c/n 02, the second prototype modified to the first series production machine), presented at 1st Aviation Exhibition, Belgrade, May/June 1938.



Ikamc IK-2 c/n 5 №2105 "White 29", 107.E, 34.VG, 4.LP, Zagreb Airport, 1940.

Ikarus IK-2 c/n 7 №2107 "White 31", 107.E, 34.VG, 4.LP, Zagreb Airport, 1940.



Ikarus IK-2 unknown c/n, 107.E, 34.VG, 4.LP, Bosanski Aleksandrovac auxiliary war airfield, April 1941.

Hawker Hurricane Mk.I

(VV Hariken – Hurricane)

Background

The famous aircraft factory, Hawker Aircraft Ltd. From Kingston-on-Thames, was responsible for the appearance of the Hurricane, one of the two most famous British fighter aircraft in the period before and during World War II. The company was created in 1933 from the older company H.G. Hawker Engineering, and already in 1935 it was reformed into Hawker Siddeley Aircraft. The already famous Hawker's chief designer, engineer Sidney Camm, developed a low wing fighter aircraft, the Hurricane, on the basis of his previous successful design, the Fury. The prototype was constructed in accordance with Specification F.36/34 and it took off for the first time on 6 November 1935 powered by a new and promising engine, the Rolls-Royce Merlin. The first series built Hurricane Mk.I took off on 12 October 1937 and the deliveries of the first of 600 ordered aircraft started the same month. A total of 3,185 Hurricane Mk.Is were manufactured, 1,900 aircraft in four batches of 600, 300 and two of 500 each at the parent factory, 1,219 in three batches of 500, 200 and 519 at Gloster Aircraft factory, 40 at Canadian Car and Foundry Co., two at Belgian Fairey Avions and 24 in the KJ at Zmaj A.D. From December 1938 until March 1940 a small number of Hurricane Mk.Is was exported to Belgium (20), Canada (19), Finland (10), Iran (1), KJ (24), Poland (1), Romania (12), South African Republic (7) and Turkey (29).

The Hurricane Mk.I fighter interceptor was the first low wing fighter and one of the two main RAF fighter types until 1941. At the time of the Battle of Britain in the summer of 1940, it equipped a total of 29 RAF Squadrons. In VV service, it was one of the two standard and the second most numerous fighter type.

The Hurricane was the first low wing fighter and the first aircraft to fly faster than 480 km/h (300 mph). It was the first standard modern fighter type to be selected, the second most numerous one, one of the two main fighter types in VV and the type selected for production by the domestic aeronautical

Hurricane Mk.I №11 from the first VV batch was selected for factory trials. Shown here, in flight over Brooklands. Note varying shades across camouflage fields which were the result of different material textures. Such appearance resulted in mistaken opinions by some modelers who claimed there were four colours in the camouflage, despite obvious facts that this machine was factory painted in a strict manner which corresponded to the two tone RAF scheme. Note the absence of antenna wire. (Malcolm Passingham via Mario Hrelja)





Another shot of VV Hurricane pattern machine during factory testing. Note the standard RAF Scheme "A" and two factory applied VV "Kosovo cross" insignia on the wings. (Malcolm Passingham via Mario Hrelja)

industry. The key reason for its choice was modern technology and ease of production as metal construction was suitable for fast series production. At the time of purchase for VV service, Hurricane was one of the best fighters in the world and it served in RAF squadrons. Its introduction significantly increased VV capabilities. While the neighboring countries still used obsolete fighters (both biplanes and high wing monoplanes), VV introduced the most modern low wing aircraft (Hurricane, Me-109 and IK-3), although in insufficient numbers.

Imported Hurricanes

VV pilots had the opportunity to fly the Hurricane Mk.I and familiarize themselves with its characteristics during April and May 1938, during the VV delegation visit to the United Kingdom. Owing to the good political relations between the UK and the KJ and the confidence in the ability of the Yugoslav aeronautical industry, which already successfully mastered the manufacturing of Hawker Fury, the British agreed to deliver 24 fighters manufactured at Hawker and to sell the license for the production of the type in Yugoslav factories. As such KJ became the first country to acquire the license for the production of such modern and complex British fighter.

Four pilots from VV commission, which was led by *puk* engineer Srbobran M. Stanojević, Chief of Technical Department within VV Headquarters, tested a Hurricane in April and May of 1938 in the UK and the contract for the 12 aircraft and the license was signed in December. The first two Hurricanes flew over on 15 December from Brooklands across France and Italy to Belgrade, a little over a year



Above: Banking left, the Silver undersides with two large "Kosovo cross" insignia are clearly visible. (Malcolm Passingham via Mario Hrelja)

Above, right: VV Hurricane approaches the "six" of the RAF Hawker Hart chase plane. (Malcolm Passingham via Mario Hrelja)

since the type was introduced into RAF service. The next 10 aircraft were shipped in April 1939. Those aircraft were taken from Hawker's first series of 600 Hurricanes. The factory test pilots conducted two test flights in Brooklands with №11 (BP.11) with take-off weight of 2,778.5 kg (6,120 lb). First was R. C. Reynell on 25 March 1939 (checking handling and characteristics) and then K. G. Set-Smith on 14 April (checking contractual performance).

The next delivery, in accordance with the agreement from 11 January and contract with Hawker from 12 January 1940, followed in March and April 1940 when the next 12 Hurricanes from Hawker's second batch arrived. Those 12 Hurricanes were the last 12 aircraft from that batch. VOG test pilot, *rez por* engineer Boris J. Cijan was responsible for Hurricane delivery acceptance into VV service.

License-built Hurricanes

The initial intent to produce 100 Hurricanes, 60 at Zmaj and 40 at Rogožarski never materialized. By securing the license and the deliveries for the British engine, VV Headquarters ordered the production of only 48 license aircraft, 24 at Zmaj and 24 at Rogožarski. Contracts with both factories were signed on 31 March 1939 while the delivery date was set at 18 months, that is 30 September 1940. According to the established procedure, VV Headquarters obliged to deliver the engines, three bladed metal propellers, radio stations and gun sights to factories while the machine gun installation was assigned to VTZ (Ваздухопловно-технички завод – Aviation Technical Depot) in Kraljevo. Besides that, the intention was to give each factory one Hurricane acquired in the UK, for use as pattern aircraft during series production. The contracted price was 1,630,170 Dinars per aircraft. A contract with Rolls-Royce was signed for the delivery of 60 Merlin III engines with the delivery date between September 1939 and March 1940.

Due to long and complex preparations, Hurricane production at Zmaj began during the summer of 1939. With the start of war in Europe on 1 September, numerous hold ups and stoppages due to suspension of deliveries from the UK and due to the April 1940 aeronautical industry worker strike in Yugoslavia slowed the work down. As a consequence, the work on first 24 Hurricanes was completed at the beginning of April 1941. The factory test pilot, engineer Boris J. Cijan, took off on 21 March in the first Zmaj-built Hurricane from the first group of 12 aircraft and on 10 April he conducted test and delivery flights for a total of 17 aircraft, while another was tested by one of the VOG pilots. Due to the immediate war danger, four Hurricanes were handed over directly to 2.LP due to the urgent request from



A fine take off shot of a VV Hawker Hurricane Mk.I.
(Malcolm Passingham via Mario Hrelja)



Middle: First imported batch Hurricanes at the VV aircraft and weapons Exhibition at Beograd Airport, 27 April 1940. Ten aircraft were lined up in two lines of five aircraft. Photograph shows the first line (from right to left) "White VIII", "White X", "White III", "White IX" and "White I". EvBr 2310 "White X" is clearly seen in this line up. All machines from the first batch (excluded the earlier lost Br.7) were marked with the newly introduced VV s/nos (EvBr) and analogous White fuselage codes. Yellow propeller tips were applied on all VV Hurricanes, imported and domestic-built. (City of Belgrade Library)

Regiment CO. The last two delivered aircraft were handed over to the pilots from the 6.LP at Beograd Airport, but a German fighter damaged one of them on the ground while they were preparing for transfer to Veliki Radinci auxiliary war airfield. Due to the delayed deliveries, some of the 2.LP pilots were unable to complete combat training with the Hurricane before the April War.

The Hurricane production at Rogožarski experienced more difficulties than at Zmaj. Until that time Rogožarski did not construct modern aircraft consisting of metal construction, its experts and workers had to embrace new technologies and skills during the construction itself, which of course slowed the work down. Apart from that, Rogožarski did not have the equipment for shaping duralumin profiles and a special machine for milling the landing gear legs, hence it placed the orders for those parts at

An aft shot taken at Beograd Airport on 27 April 1940 shows the second line with Hurricanes (left to right) "White XI", "White XII", "White IV", "White V" and "White II". Note the factory applied standard RAF camouflaged schemes, Type "B" on even numbers and Type "A" on odd numbers, where these even-odd numbers refer to the original RAF series numbers. (City of Belgrade Library)



*Hawker Hurricane EvBr
2305 from 4.LP at Zagreb
Airport in the early spring of
1941. (Tomislav Aralica)*



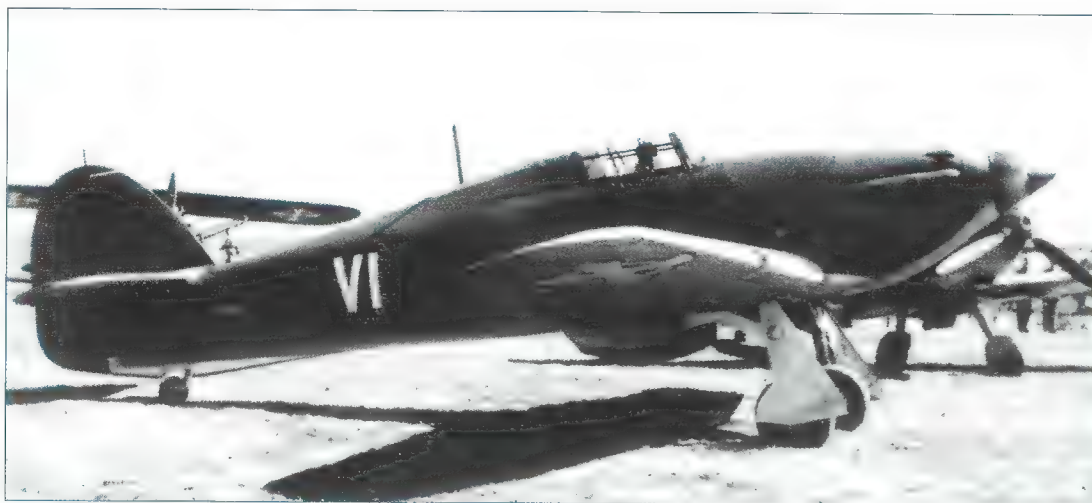
Zmaj, which was at the time overwhelmed with its own Hurricane manufacturing. The biggest problem in the end were the Merlin engines, which were not delivered from the UK, and which led to a decision to re-engine the Hurricanes at Rogožarski with DB.601Aa engines. These engines were readily available for purchase in Germany. Rogožarski did not manage to complete a single aircraft, despite completing 78% of parts and sub-assemblies for the 24 aircraft on order. A number of aircraft was in the assembly line and according to the Headquarters' estimate, those aircraft with DB.601Aa engines, were slated for completion at the latest by August 1941. It is important to stress out that the domestic industry, in an effort to substitute the imported parts for the Hurricane, produced amongst others, the landing gear legs (in cooperation between Rogožarski and Ikarus) and three bladed metal propellers (in cooperation between Rogožarski and IAM).

The Hurricane was officially classified in VV as "једномоторни авион једносед за борбу са мотором Ролс-Ројс Мерлин од 1044 KS на висини искоришћења 4720 метара" (single seat combat aircraft with Rolls-Royce Merlin engine with 1,044 KS at 4,720 meter altitude). According to factory manual, this engine developed maximum 1-minute power at take-off of 902 mhp (890 hp) at 3,000 rpm at 305 m and maximum 5-minute power of 1,044 mhp (1,030 hp) at 3,000 rpm at 5,030 m (Merlin II) or 4,953 m (Merlin III), using 87 octane fuel.

*Hurricane 2306 "White
VI" pictured here shows the
location of the large 114 cm
diameter "Kosovo Cross"
on each wing. (Aviation
Museum – Belgrade)*

All VV Hurricanes were of Mk.I version and they differed according to several details, depending on which series they belonged to. The first 12 aircraft had Rolls-Royce Merlin II engines and two blade Watts Z.38 propellers (which were replaced by three bladed ones before the war), while the remaining ones had Rolls-Royce Merlin III and three bladed de Havilland/Hamilton Standard Hydromatic DH.5 propellers. Some of the license built aircraft had domestic Rogožarski U-21 three bladed propellers with mechanical





With its engine running, 2306 "White VI" is preparing for take off. This machine was selected for flying program during the Exhibition at Beograd Airport, 27 April 1940. In the background is another VV fighter, Messerschmitt Bf 109E-3a coded L-7 (Milan Micevski)



The same Hurricane prior to take off on the same day. (Milan Micevski)

commands, which was based on the Gnôme-Rhône 14K engine design solution. The first 12 imported and license built aircraft had fabric covered wings, the original non armored windscreen and radio masts. The 12 aircraft imported in 1940 had metal stressed skin wings, new bulletproof windscreen and a new type radio mast.

The Yugoslav Hurricanes were equipped with eight 7.9 mm M.38 (FN Browning) machine guns, each with 320 rounds per gun. Several of the last Zmaj aircraft could not be equipped with FN machine guns due to shortages (similar to other VV aircraft) hence they received the older 7.7 mm M.30 (Darne) machine guns. All aircraft used Teleoptik gunsight, a licenced *Collimateur Chrétien E.T.Aé Modèle 1933*. Furthermore, the trigger mechanism was manufactured by Dunlop, gun camera by O.P.L and radio set was Standard R-10. The imported types had British oxygen equipment, while Zmaj aircraft were equipped with breather mask (inhalator) and the instruments produced under the British license. The pilot and the engine instruments were installed according to the British specification and were mostly manufactured in domestic factories and all were suitable for night flights. The inscriptions on the instruments and the equipment were in Serbian language in Cyrillic letters.

Hurricane was relatively simple for manufacture and maintenance. Its robust construction tolerated loads and was easily repaired in field conditions. The aircraft maneuvered well and could take off from all terrains at any time. Most importantly, an average pilot was able to get the maximum out of the Hurricane and be combat capable.

| VV Hurricane Mk.I deliveries | | | | |
|------------------------------|----------|-------------|----------------------|--------------------------------|
| Date | Quantity | VV EvBr | Manufacturer | Note |
| 12/1938 | 2 | 2301-2302 | Hawker Aircraft Ltd. | 1 st imported batch |
| 4/1939 | 10 | 2303-2312 | | |
| 3/1940 | 12 | 2313-2324 | | 2 nd imported batch |
| 3-4/1941 | 15 | 2325-2339 | Zmaj A.D. | 1 st domestic batch |
| in war | 9 | 2340-2348 | | |
| (9/1941)* | (24)* | (2349-2372) | Rogožarski A.D. | 2 nd domestic batch |

* ordered, undelivered, 78% of parts finished until the April War

VV Exhibition, 27 April 1940: (top) HM King Petar II Karadjordjević and arm den Milojko Janković C-in-C of VV inspecting the cockpit of Hurricane 2306. Note the lack of armored windshield, the two bladed propeller and removed gun muzzle protector on the port wing leading edge with the four FN Browning machine guns clearly visible; (bottom) The same machine prepared for take-off. (both Milan Micevski)



The Hurricane with Daimler-Benz (LVT-1)

During the summer of 1940 it was obvious that due to the war blockade, the UK will not deliver the contracted Merlin III engines for Hurricanes which were on order at Rogožarski. To test the capabilities of Hurricane equipped with an alternate engine, the Technical section within VV Headquarters completed in 1940 preliminary calculations for the installation of DB.601Aa engine (the same engines installed in the Yugoslav Me-109 fighters) in the British aircraft. In accordance with the project received from the Technical section (project engineer Ljubomir D. Ilić), the design bureau at Rogožarski performed an adaptation of a standard British built Hurricane (pattern aircraft Br.1/2301) to the alternate engine. Rogožarski signed contract Pov. V.T. Br. 440/40 with VV Headquarters during the summer of 1940 for the construction of a prototype at cost of 296,386 Dinars. The Hurricane derivative, named LVT-1 (*ЛВТ-1, Ловац ваздухопловно-технички први* – Fighter Aviation-Technical First or Fighter aircraft modified by Technical Department), performed in some aspects better during testing than the original.

The work on the adaptation was started on 21 September 1940 and finished on 21 February 1941 after spending 6,426.80 hours, 2,003.80 at the Belgrade factory and 4,423 at the Rogožarski's new hangar at Bežanijska kosa (near Beograd Airport). To shorten the time for the necessary engine adaptation, the pattern Hurricane and one of the available Me-109 were placed side by side. The measurements were conducted on site pursuing the best options for the installation of DB.601Aa engine into a Hurricane. The adaptation required the construction of a new engine mount and new cowlings, radiator relocation, changes to cooling and lubrication piping, engine instruments and engine commands. The engine mount for LVT-1 incorporated one component from the twin engine IK-5 heavy fighter (part 35 according to drawing 5028), which was then under construction. The glycol cooler was manufactured by *Aeromehanika* company, which did the same for the IK-3 fighter. During the adaptation, a 20 mm centrally mounted cannon installation was trialed, although there is no information if LVT-1 flew with



Hurricane 2302 (No.2) prior to a test flight at Beograd Airport. Note the old type pitot-tube below the windshield and RAF Scheme Type "B". (Milan Micevski)



Hurricane 2301 (Br.1) put on wooden supporters, surrounded by VOG's members. Note RAF Scheme Type "A". (Miloš Milosavljević)

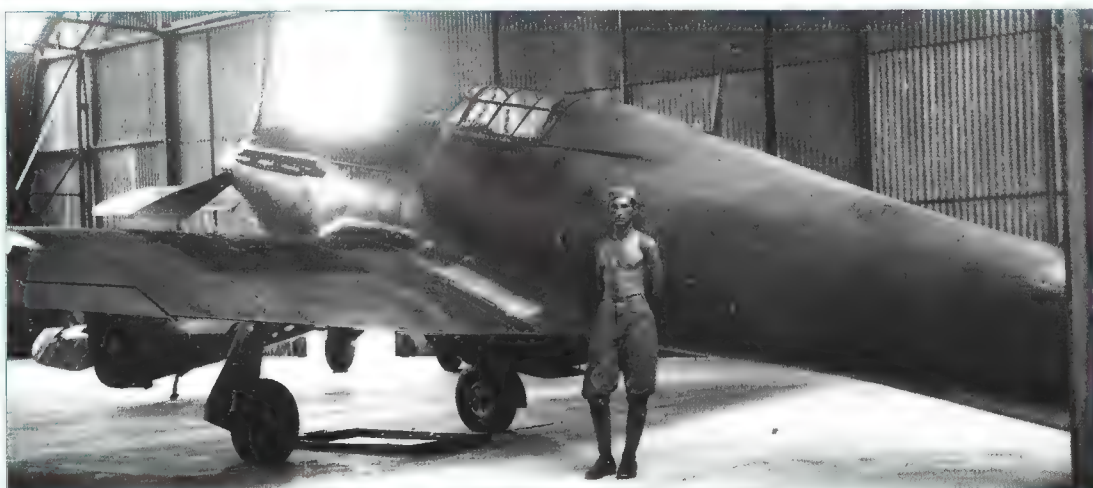


Front view of two blade propeller VV Hurricane. Note the old type windshield and ring-and-bead gun sight. (City of Belgrade Library)

Metal wing Hurricane from the second imported batch at Bitolj airfield. Note the metal three bladed propeller, armored windscreen and Black undersurface of the port wing. (Milan Micevski)



Another shot of a metal wing Hurricane at one of the hangars at Zagreb Airport. Note the absence of Escadrille numbers on the fuselage. The soldier beside the Hurricane is mechanic Relja Nedić, post-war military control head at Utva factory. (Dragan Kolundžić)



4.LP Hurricane from the second imported batch in a hangar at Zagreb Airport. (Dragan Kolundžić)





EvBr 2301, the first machine of the first 12 imported Hurricanes, was marked with Roman numeral I on the fuselage. This photo was taken at Zagreb Airport in the spring 1940 when 2301 was in service within 4.LP. This aircraft was later converted to DB-601 engine and as such would get new VV designation LVT-1. It was handed over to VV on 7 April 1941, but its exact fate remains unknown. (Dragan Kolundžić)

such armament. The date of the LVT-1 first flight is not known (the beginning of March 1941) and the aircraft was tested at VOG with pilot *kap Ik* Miloš Bajagić. It was flown to Kraljevo when VOG transferred to that airport.

Unfortunately, the fate of LVT-1 is not clear to this day. According to the fabrication schedule and payment records dated 6 April 1941, the aircraft was listed as number 10 on the list as "LVT, 100% completed". The aircraft was handed over to VV at the beginning of the war, most likely on 7 April, and further traces lead to 2.LP 52.VG at Knić auxiliary war airfield. The aircraft unfortunately did not survive the war.

The sole LVT-1 was practically a pattern aircraft for the future Rogožarski production. The alternate engine was a successful solution in case of a change in political situation leaning towards Germany (similar situation took place with modification of IK-3 to alternate engines). The decision to proceed with LVT production led to abandoning the DB engine installation in the IK-3. In both cases, whether KJ relied on UK or Germany, the domestic aeronautical industry would be manufacturing Hurricanes, either with Merlin or DB engines.

Another alternate engine which was under consideration for use in Hurricane was the Italian 900 mhp (888 hp) Isotta-Fraschini Asso L.121 RC40. The request by the VV for import of 50 engines was never fulfilled.

Peace time service

British made Hurricanes were introduced in service with 6.LP and after the arrival of Me-109 and IK-3 fighters to that unit, the first 12 machines were transferred from the spring of 1940 until July of 1940 to 4.LP, while the remaining 12 imported machines were delivered directly to Zagreb. The license produced aircraft were introduced at the beginning of 1941 in 52.VG, and on 1 March 1941 2.LP was created. The regiment was completed a month later, and it included 52.VG with its Hurricanes.

Following the Italian attack against Bitolj (Monastir) and Prilep, a specially formed combined unit of Hurricanes from 4.LP (105.E and 106.E) was based during the November and December 1940 at Veliki Konjari auxiliary airfield near Prilep. The aircraft remained in Old Serbia (now North Macedonia) until March 1941. During their basing there, Hurricanes forced two aircraft to land. On 14 December 1940 *nar* Nikola Vučević, during a patrol from Bitolj forced a Greek Henschel Hs-126K-5 from 3. *Mira Stratiotikis Synergassias* EVA to land near Bitolj. Two officers were interned and then returned by an aircraft. On 1 March 1941 *ppor* Puniša Bogičević forced a German Junkers Ju-52/3m from IV/KGzBV 1 with eight crew members to land at Skoplje Airport. In a report dated 9 March 1941 addressed to the VV CO, it was indicated that the Hurricanes from 105.E, which were patrolling the southern borders of the Kingdom, were inspected by a commission during 4 and 8 March to verify the fabric damage and the engine serviceability. The report mentioned seven Hurricanes, of which four (2312, 2314, 2315, 2322) were based at Skoplje and

Hawker Hurricane from the second imported batch displayed at the French Pavilion at the fair in Zagreb during September 1940. Note the illegible White EvBr at the fuselage side and the absence of White inscriptions of the starboard side of the rudder. (Robert Čopeć)



A VV officer is presenting the same Hurricane to the visitors at Zagreb fair. (Tomislav Aralica)



three (2305, 2317, 2318) at Bitolj. Three blade propellers were requested for aircraft 2312 and 2322 since at the time „these had two blade propellers installed”. Gradual replacement of the original two blade propellers began during the second quarter of 1940. In the pilot logbook belonging to *kap IIIk* Zlatko Stipčić there is a record of a flight which took place on 25 April 1940 in a Hurricane 2304 from Beograd Airport with the purpose to „test the aircraft with new variable pitch propeller”.

Two Hurricanes were heavily damaged until the April War. *Nv IIIk* Isailo M. Vićovac died in an accident on 7 August 1939 at Velika Krsna village near Mladenovac while flying Hurricane BR.7. The aircraft was officially struck off charge on 13 January 1940. The second Hurricane, 2306, was damaged on 19 June 1940 when pilot Vladimir Bosner, collided with Messerschmitt Bf 108B-2 (VV Me-108 EvBr 777 Š-07) while landing at Zagreb Airport. The aircraft was not repaired until April 1941. VV report from 30 June 1940 listed 22 operational and one inoperable Hurricane. At least two Hurricanes were repaired at Ikarus in 1939 and 1940 while Zmaj did not partake in any repairs.

During 1940, three minor accidents with Hurricane fighters took place, without pilot injury. On 10 February, while landing at Skoplje Airport *nar* Bojan J. Grgić flipped over Br.2302 aircraft on its back (sustaining 20% damage). *Nar* Radivoje Stikić flipped over on 6 November also while landing at Beograd Airport. At the very end of the year, on 31 December, *ppuk* Radoslav Djordjević was unable to take off from snow covered runway at the same location, and came to a stop outside the airport boundaries with Br.2310 sustaining 12% damage.

On 7 March 1941, three Hurricanes (2302, 2313 and 2316) were at Zmaj factory for repairs. They had their tires temporarily removed, as these were installed on new built aircraft, in order to avoid delivery delays.

| Hurricane equipped VV units | | | | | | | | |
|--|----------------|------------|---------------------------------|-------|-------------------|----------------------------|--|---|
| Unit | Period | Base | Note | | | | | |
| 6.LP | 1939-1940 | Beograd | 51.VG only | | | | | |
| 4.LP | 1940-1941 | Zagreb | 33.VG, 34.VG | | | | | |
| 2.LP | 1941 | Kragujevac | 52.VG only | | | | | |
| Aviation Groups: | | | | | | | | |
| 33.VG | 1940-1941 | Zagreb | 4.LP | | | | | |
| 34.VG | 1940-1941 | Zagreb | 4.LP | | | | | |
| 51.VG | 1938-1940 | Beograd | independent until August 1939 | | | | | |
| 52.VG | 1941 | Kraljevo | in 2.LP, Knić from 7 April 1941 | | | | | |
| VV Hurricane 1937-1941 deliveries and serial numbers | | | | | | | | |
| Manufac-turer | Type | Deliveries | Quan-tity | № | EvBr since 4/1940 | c/n | RAF s/n | Note |
| Hawker | Hurricane Mk.I | 1938 | 12 | 1-12 | 2301-2312 | 205, 206, 291-294, 312-317 | L1751, L1752, L1837-L1840, L1858-L1863 | 1 st imported batch; codes I-XII |
| Hawker | Hurricane Mk.I | 1940 | 12 | 13-24 | 2313-2324 | | N2718-N2729 | 2 nd imported batch |
| Zmaj | Hurricane | 1941 | 24 | 25-48 | 2325-2348 | 1-24 | - | 1 st domestic batch |
| Hawker/Rogožarski | LVT-1 | 1941 | (1) | 1 | 2301 | 205 | ex-L1751 | conversion to DB.601Aa |
| Rogožarski | Hurricane | - | (24) | 49-72 | 2349-2372 | 25-48 | - | 2 nd domestic batch |

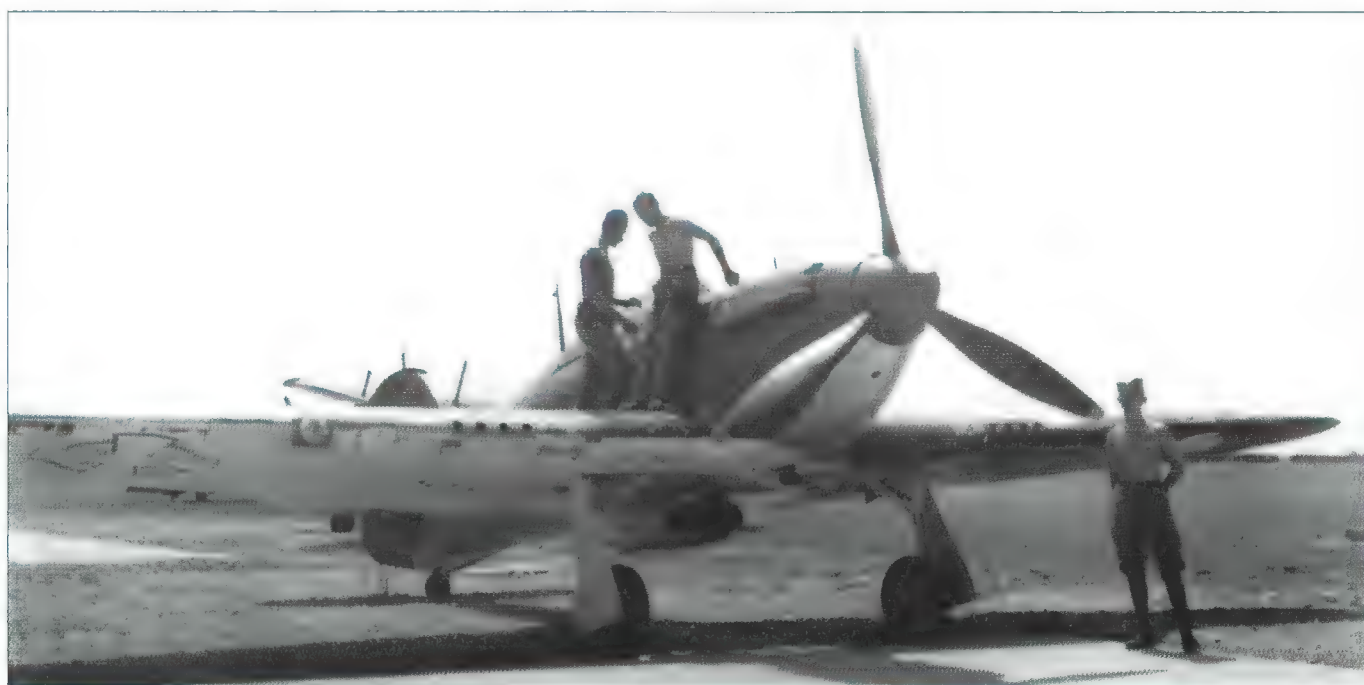
1941 April War

At the beginning of April 1941, VV had 35 operational Hurricanes. On 6 April, 15 Hurricane fighters (plus LVT-1 from 7 April) were assigned to 2.LP 52.VG (163.E and 164.E) based at Kraljevo and 16 to 4.LP 33.VG (11 aircraft in 105.E and 106.E) and 34.VG (five aircraft in 108.E) based at Bosanski Aleksandrovac. Four machines based at Kosor-Mostar were used by 3.LPŠ.

On the first day of the war, four Hurricanes from 4.LP were unavailable, two of them were in repairs: one at Zmaj (wings from 2306 were at Zmaj for repairs and fuselage was at Zagreb workshop) and one damaged aircraft was at Gorica-Zagreb workshop (without engine).

A total of nine brand new aircraft were delivered from Zmaj during the war. In the days prior to the beginning of the war, Hurricanes from 2.LP 52.VG based at Kraljevo Airport regularly patrolled along the border with Bulgaria to prevent any potential incursion into the Yugoslav territory. In the early morning hours of 6 April, 2.LP CO was informed that the border listening posts detected German

Second imported batch Hurricanes had a characteristic RAF Black and White wing undersurfaces and Aluminium painted fuselage and tail plane undersides. Note that the "Kosovo Cross" was applied over the original RAF roundels. (Dragan Kolundžić)



Hurricane pilots during the winter of 1940/1941 in front of first imported batch Hurricane under repairs. First from right is kap Iłk Dragiša Milijević and next to him is kap Iłk Franc Berginc. First one on the left is kap Iłk Miloš Maksimović, the third is kap Iłk Mladen Milovčević, ppor Stanislav Kodre sits on the wing. (Milan Micevski)



Eight cheerful Hurricane pilots posing in front of two bladed propeller machine. (Illustrated Magazine No 7 Vol. III April 12 1941 via Djordje Nikolić)



Luftwaffe personnel from JG 54 "Grünherz" posing with one of the two Hurricanes captured at Beograd Airport. This aircraft was lost shortly thereafter in an accident on 25 April 1941. (Jan van den Heuvel)

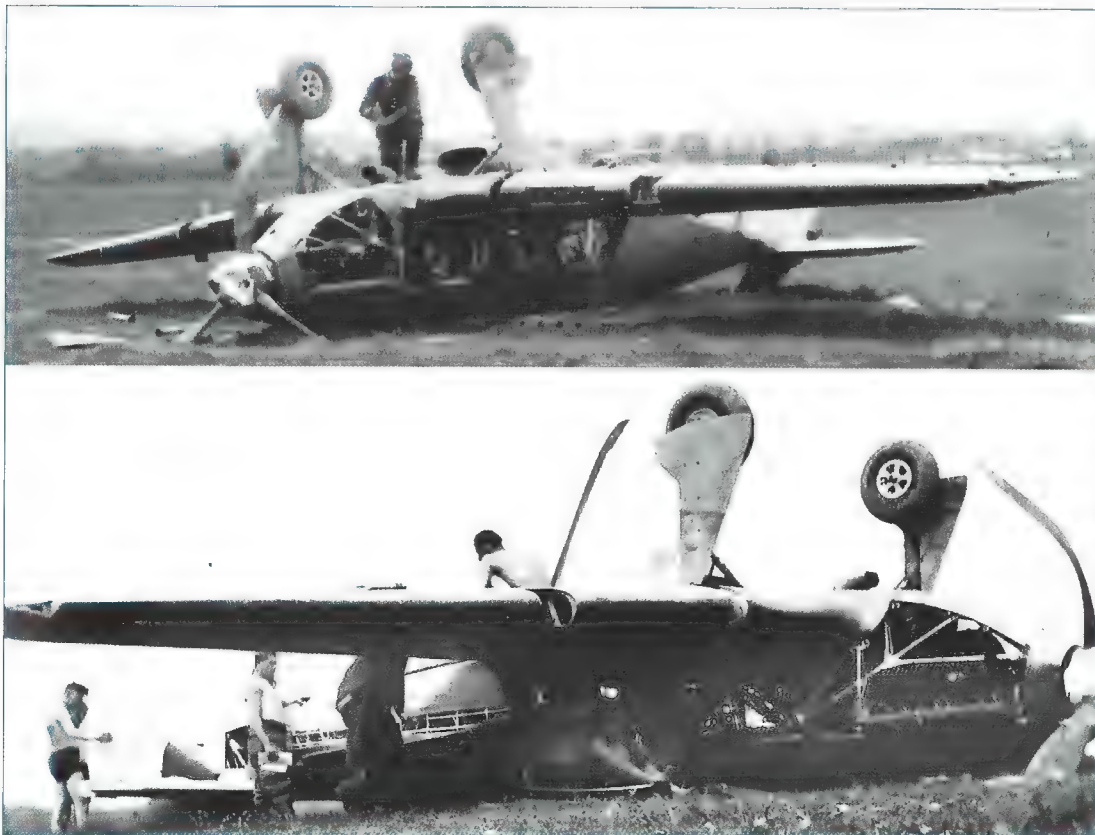


aircraft preparations at the Romanian airfields. Immediately, the 52.VG was brought to the full combat alert status remaining at Kraljevo instead of dislocating to Knić auxiliary war airfield, situated between Kraljevo and Kragujevac. Their combat effectiveness was further reduced since all the aircraft lacked Standard R-10 radio stations which were purchased, but never installed. Still the first patrol took off from the airport and an hour later the entire group was ordered to dislocate to Knić, with 163.E arriving there first. Once there, the 163.E aircraft were well camouflaged to prevent detection by the enemy aircraft. Following the order from the 2.LP CO to take off with all available aircraft in the direction of Belgrade and face the enemy which was ruthlessly bombing the city, a total of eight aircraft from 163.E took off. Being that the 164.E was still at Kraljevo and was preparing to leave for Knić, its six fully armed and fuelled Hurricanes took off towards Belgrade to join the 163.E which took off before them. Since the order for take off was issued late, both *Escadrilles* failed to encounter the enemy above Belgrade and after a brief patrol returned to Knić. During the return to this airfield, on which many pilots never landed before, two accidents took place as a result of broken landing gear. From that moment 52.VG had only 12 Hurricanes available plus one left unserviceable at the group's workshop at Kraljevo home base. At Kraljevo, this aircraft caught the attention of *por* Djuro Ivanišević and he took charge of it without sufficient knowledge of why the aircraft was unserviceable. He soon found out while landing at Knić when his breaks locked up which resulted in the aircraft flipping over. For the remainder of the day both *Escadrilles* conducted several patrol flights above the industrial area without encountering enemy, despite their urgent need in the defense of Belgrade.

The next day due to the passive leadership by 2.LP CO, *ppuk* France Pirc, who again failed to commit to protecting Belgrade from *Luftwaffe* attack and as a result, useless patrol flights continued above the area where no enemy activity was encountered, or the patrols were sent with significant delay and the enemy had the opportunity to leave the area. On the positive side, two brand new Zmaj built Hurricanes were transferred from VOG based at Kraljevo. Additionally, the only Hurricane equipped with the DB.601Aa engine, LVT-1, was flown over to Knić by *maj* Siniša V. Nikolić.

On 8 April, 2.LP was ordered to attack German armored columns located at Kačanik gorge. During this low-level attack, several aircraft from both *Escadrilles* were damaged, with all but one managing to return back to the airfield. They failed to inflict any major damage or slow down the German advance. Towards the end of the day, additional two brand new Zmaj built Hurricanes were transferred to Knić bringing the number of available aircraft to 15 again.

On 9 April three more brand new Zmaj built Hurricanes were delivered to Knić by pilots from VOG at Kraljevo. It is interesting to note that all of the newly build aircraft lacked some of the cockpit instrumentation and allegedly weapons as well.



Two shots of remains of the Hurricane 2326 belonging to 52.VG 163.E CO kap Ik Miloš Bajagić near Valjevo. He crashed on 12 April 1941 while returning from Beograd Airport and died from his wounds the next day in the hospital. German soldiers are inspecting it and removing the armament. Note the White spinner on this machine. (both Djordje Nikolić)

A woman with children sitting on Zmaj Hurricane 2348 damaged wing after 1941 April War. Note the bent wing fabric cover and asymmetrical small cockade on the upper side of the port wing contrary to many known Zmaj-built Hurricanes. The photo was taken at auxiliary war airfield Veliki Radinci where that machine was torched by its crew on 12 April. After WWII the woman gifted this photo to Čedomir Janić, later director of Yugoslav Aeronautical Museum. (Aviation Museum – Belgrade)



Following the meeting at the 2.LP Headquarters which took place on 10 April, a decision was made to fly the aircraft to Veliki Radinci auxiliary war airfield. The first five aircraft from 164.E took off led by *kap Ik* Ivo Oštrić (2327). In route, due to poor visibility which was the result of worsening weather conditions, his wingman *por* Mato Momčinović collided with his aircraft. Both aircraft crashed and pilots perished. Hurricane flown by *nvtč IVk* Veljko Vujičić (2339) crashed as well after striking some trees in Kragujevac region, as he exhausted fuel during the low-level flight (while circling and waiting for his already lost companions). The two remaining pilots, *nvtč* Blaža Radovanović and *nar* Branslav Nedeljković returned to Knić. No further attempts to fly over were undertaken by either *Escadrille* and 2.LP CO Pirc ordered that all aircraft belonging to 52.VG be destroyed. *Nar* Uroš Perović defied this order and took off with a Hurricane and landed at the wartime airfield Ortiješ near Mostar occupied by Savoia-Marchetti SM-79s from 81st Independent Air Group. Back at Knić, Hurricanes were only damaged by piercing their fuel tanks and retracting their landing gear on the ground. The air and ground crews began their retreat towards Bosnia, deeper inside the Yugoslav territory. Ironically, already the next day, 11 April, KV ordered the immediate return to Knić.

The next day the crews began hastily repairing the damaged aircraft which they left just two days ago, managing to make only six of them serviceable. Three of those aircraft piloted by 2.LP CO *ppuk* France Pirc, *rez por* Boris Cijan, and 163.E CO *kap Ik* Miloš Bajagić took-off towards Belgrade. As *ppuk* Pirc and *rez por* Cijan landed and approached the hangars, they were disarmed by *Volksdeutchers* which took control of their aircraft forcing them to surrender (one of these two machines was EvBr 2328). *Kap Ik* Bajagić, having seen what happened to the other two, turned his aircraft around and took off with the intent to land at Divci auxiliary war airfield, near Valjevo. During landing, due to soft terrain, this aircraft flipped over. He was gravely wounded and succumbed to his injuries the next day. Another two Hurricanes took off towards Veliki Radinci auxiliary war airfield with *kap IIk* Bogdan Veljković and *nar* Milisav Šurbatović but noticed German troops there, so they returned to Knić. Due to lack of fuel for further operations, both aircraft were destroyed. One Hurricane (2337) with *nar* Simon Ramšek flew over to Butmir airfield in Bosnia where the aircraft was transferred further to Nikšić by *kap IIk* Vojislav Rakić. This Hurricane was used to protect the bombing attacks by VV SM-79s against targets in Albania and to patrol the airspace above Nikšić while King Peter II retreated towards Greece. *Kap IIk* Rakić attempted to fly over to Greece as well but had to return due to a malfunction. This is where the aircraft was captured by the Italians, following which it was transferred to Tirana airfield in Albania and finally to Guidonia test center in Italy. During combat with German Bf 109 from 9/JG54 on 15 April this machine received 17 hits, and as a result of combat damage it was unable to retract its landing gear so the remainder of the flights were conducted with gear down!

4.LP Hurricanes were on increased combat alert status since 22 March 1941, few days before coup d'état. They were well informed of the coming German attack hence on 4 or 5 April five Hurricanes from 33.VG 105.E were transferred to Veliki Radinci auxiliary war airfield as a reinforcement for 6.LP where for unknown reasons they remained inactive in the defense of Belgrade. When the time came to retreat towards Bosnia, these five aircraft were unable to take off due to poor weather conditions which drenched the airfield. The only remaining action the crews could do was to torch the aircraft to prevent their capture by the enemy.

Despite the knowledge of imminent German attack, no official information was received by 4.LP Headquarters and the first news of the German attack were heard instead over the radio. The first patrols immediately took off and headed towards the borders of Austria and Hungary where they spotted ene-



my reconnaissance aircraft but were unable to intercept them. Two Hurricanes were selected to provide fighter cover for Bristol Blenheims from 8.BP while these attacked railway station in Graz and *kap Ik* Janko Dobnikar strafed an enemy column on the road he flew over. During this flight, he lost contact with the bombers but at Zidani Most around 13:00 he engaged in combat with a lone German Bf 109 and claimed a victory. The next day 4.LP maintained the protection of the assigned territory and assistance to 8.BP. In spite of the pre-planned arrangements, the Blenheims headed towards Hungary without waiting for their Hurricane escorts and as result incurred tremendous losses. The same day German group of 27 *Luftwaffe* Bf 109 aircraft commenced dogfight over 8.BP airfield at Rovine against a group of six VV Ikarus IK-2s and four Hurricanes (106.E and 108.E with two aircraft each). During the brief combat, 106.E CO *kap Ik* Dragiša Milijević lost his life when his damaged aircraft was attacked during landing by several German fighters. His wingman *nar* Milan Mitić managed to bail out but was shot at by a German fighter while gliding towards the ground. He returned fire from his side arm! A total of three Hurricanes were claimed by Germans during that engagement. Two German fighters were claimed in return, one shared by *kap Ik* Milijević and *nar* Mitić and one by *nar* Živorad Tomić.

On 8 April a total of nine Hurricanes remained operational and all *Escadrilles* maintained air cover of 8.BP area of operations above Croatia and Slovenia guided by the observation posts at the borders. On one such occasion during a dogfight a pair of Yugoslav Hurricanes fought Bf 109s but neither side managed to score any hits.

On 9 April, the same patrols continued with only sporadic action against reconnaissance aircraft. The same day German pilots from I(J)/LG2 claimed two Hurricanes and one IK-2 shot down above Fruška Gora in the direction Belgrade-Novı Sad but on that day Yugoslavs have no losses.

On 10 April, despite poor weather conditions, *kap Ik* Janko Dobnikar managed to damage a Bf 110 which returned to the airfield. The same pilot allegedly shot down a Junkers Ju-88 on 11 April. Yugoslav pilots had no losses during that day.

Due to the worsening war situation, 4.LP received the order to prepare a retreat towards Sarajevo. Even with the favorable weather conditions, the order was issued to torch the aircraft and retreat on ground only. When Germans eventually arrived, they captured the flipped over Hurricane belonging to *kap Ik* Vajo Grbić who crash landed after being badly wounded by return fire from one of the German bombers he attempted to intercept on 12 April. An additional Hurricane without its engine was captured in the vicinity of Zagreb, it was awaiting engine repairs which were never completed, although unconfirmed it is likely that it was one of the following three machines: 2308, 2309 or 2311.

On 11 April, the last two newly built Zmaj Hurricanes were prepared for a ferry flight from Belgrade to Veliki Radinci auxiliary war airfield when lone German Messerschmitt Bf 109E appeared above the airfield and strafed them. Only one of them was damaged (2347), while *maj* Adum Romeo successfully transferred the other to Veliki Radinci where it was torched along with other 6.LP aircraft. The damaged aircraft which remained at Beograd Airport was captured by *Volksdeutchers* on 12 April. A total of two of the captured Hurricanes at Beograd were repaired and were flown by Stab JG 54 for some time.

3.PS was based at Mostar-Kosor airfield and its 2nd Detachment had eight fighters (four Hurricanes, two Me-109s and two BH-33s) and eight unarmed machines (three BH-33s and five Furies). Hurricane EvBr 2317 arrived to Mostar in March 1941 as the fourth machine of this type in the unit. Unfortunately, these fighters were not fully armed, Hurricane's machine guns had only 200 rounds per gun instead of 320, as there was an insufficient number of linkages. In the Italian zone of attack against the KJ on 6 April, at 07:30 three Hurricanes and two Me-109s from Mostar-Kosor intercepted 11 CANT Z.1007bis bombers of 35^o *Stormo* attacking Mostar. The fighters split up the bomber formation and *mv IIIk* Milan

Ex-VV Hurricane ready for delivery to Romanian Air Force. It was one of three Zmaj-built Hurricanes from German war booty which were sold to German ally, Romania. Note the original VV three-tone camouflage and small White Zmaj logo on the vertical stabilizer, the newly applied Romanian flag on the rudder and Axis tactical markings (Yellow nose and strip around the fuselage). The other insignias are not yet applied. (Jan van den Heuvel)



Captured VV aircraft at Beograd Airport, late spring 1941. In the left row are three Hurricanes and a Caproni Ca-310bis "White 3". In the right row are Zmaj R-1, two Caproni Ca-310s and Aeropot's DH-89 Dragon Rapide. The first (Br.2328) and the third Hurricane still carry the VV tail stripes (small "war flag"), while the second Hurricane has Romanian flag painted on the rudder (small part of ex-VV flag is seen on the vertical stabilizer). Note the small Zmaj logo on the vertical stabilizer of the first Hurricane. Two Ca-310s have new VV three-tone camouflage applied by Ikarus during repairs shortly before the April War. (Jan van den Heuvel)

Delić, flying a Hurricane, damaged one of bombers (two crew members were wounded). Por Milan Marjanović claimed two Machi C.200 escort fighters from 370^a Squadriglia, although his Hurricane was damaged. One C.200 crash landed by Korčula while the other is known to have crash landed at Grottaglie airfield. A pair of Bf 110s from III./ZG.26 on a return flight from Sarajevo attacked Hurricane belonging to and *nv IIIk* Delić as he was landing at Kosor. As a result, the pilot was wounded and his Hurricane was damaged beyond repair. The same day around noon, two Me-109s and a Hurricane attacked a formation of 10 Z.1007bis of 47^o Stormo and 2nd Detachment CO *kap IIIk* Danilo Grbić managed to damage one bomber. During the third attack at Mostar a little before 16:00, Hurricane belonging to *kap IIIk* Grbić was shot down by the escort Bf 110s from III./ZG.26. The pilot managed to bail out but succumbed to his wounds after four hours. In the late afternoon *por* Djordje Vasojević flying the third 3.PS Hurricane, claimed a reconnaissance SM-79 shot down over Neretva estuary, which was actually a German He-111 bomber which returned safely to Italy.

On 12 April, *nvtč IVk* Franc Godec, at the command of the same Hurricane, intercepted Ju-88s from III./KG.51 which were attacking Mostar Airport. During the engagement his aircraft was damaged and he had to bail out near Jasenica airfield. This marked the end of Hurricane's service in 3.PS.

| VV Hurricane – Order of battle 6 April 1941 | | |
|---|--|----------------|
| 4.LP (CO <i>ppuk</i> Radoslav Djordjević) | | |
| 33.VG (CO <i>maj</i> Nikola Nikolić) | | |
| auxiliary war airfield Bosanski Aleksandrovac | | |
| 105.E (CO <i>kap Ik</i> Aleksandar Radičević) | | 5 Hurricanes** |
| 106.E (CO <i>kap Ik</i> Dragiša Milijević) | | 6 Hurricanes |
| 10.AC (CO <i>kap Ik</i> Miodrag Laušević) | | - |
| 34.VG (CO <i>maj</i> Arsenije Boljević) | | |
| auxiliary war airfield Bosanski Aleksandrovac | | |
| 107.E (CO <i>kap Ik</i> Žarko Vukajlović) | | 7 IK-2s |
| 108.E (CO <i>kap Ik</i> Mladen Milovčević) | | 5 Hurricanes |
| 11.AC (CO <i>kap IIIk</i> Marijan Dvoržak) | | - |
| 2.LP (CO <i>ppuk</i> France Pirc) | | |
| 52.VG (CO <i>maj</i> Miodrag Blagojević) | | |
| Kraljevo Airport* | | |
| 163.E (CO <i>kap Ik</i> Miloš Bajagić) | | 8 Hurricanes |
| 164.E (CO <i>kap Ik</i> Ivo Oštrić) | | 7 Hurricanes |
| 24.AC (CO <i>kap Ik</i> Nikola Pivlj) | | - |
| 3.LPŠ (CO <i>maj</i> Vladimir Tihomirov) | | |
| 2 nd Detachment (CO <i>kap IIIk</i> Danilo Grbić), auxiliary war airfield Kosor-Mostar | | 4 Hurricanes |
| | | 2 Me-109s |

* from 7 April 1941 relocated to auxiliary war airfield Knić

** before the war 105.E detached to 6.LP at Veliki Radinci airfield



Two shots of EvBr 2337 captured by the Italian Army: (left) still with VV insignias and subsequently mounted unpainted port engine cowling; (right) with newly added Italian White cross on the rudder and White strip around the fuselage. (via Šime Oštrić)

| VV Hurricane in 1941 April War (reconstruction) | | | |
|---|--|----------------------|---------------------------------------|
| 2.LP | 4.LP | 6.LP | 3.PS |
| 2301*, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346 | 2305, 2308**, 2309**, 2310, 2311**, 2313, 2316, 2319, 2320, 2321, 2323, 2324 | 51.VG 2347+, 2348 | 105.E 2312, 2314, 2315, 2318, 2322 |
| | | | 2302, 2303, 2304, 2317 |

* LVT-1

** one of these was captured by Germans without engine at Velika Gorica, hence it was not operational during the April War

+ remained at Beograd Airport following strafing by German fighters

Note: 2306 at overhaul, 2307 destroyed in 1939

| VV fighter pilots killed in Hurricanes during 1941 April War | | |
|--|------|--|
| Rank, name and surname, role | Unit | Date, location and cause of death |
| kap IIk Danilo M. Grbić, CO 2 nd detachment | 3.PS | 7 April, Trnovo village at Sarajevo-Kalinovik road, shot down in air combat |
| kap Iik Dragiša M. Milijević, CO 106.E | 4.LP | 7 April, war base Topola, Banja Luka, shot down in air combat |
| kap Iik Ivo Š. Oštrić, CO 164.E | 2.LP | 10 April, auxiliary war airfield Knić, between Kraljevo and Kragujevac, all lost in clouds and crashed |
| por Mato F. Momčinović | 2.LP | |
| nvtč IVk Veljko Lj. Vujičić | 2.LP | |
| kap Iik Miloš P. Bajagić, CO 163.E | 2.LP | 12 April, near Valjevo, ground fire, emergency landing |

After the War

After the war, the Italians captured two Hurricanes, 2317 at Mostar (the fourth and the last survived machine from 3.PS) and Zmaj built 2337 at Nikšić (the machine abandoned by kap IIk Rakić). In addition, remnants of nar Perović's Hurricane also fell in Italian hands. Hurricane 2337 was transferred to Belgrade for repairs (because Italians were unable to repair it at Mostar) and following the repair at Ikarus, Germans returned it to the Italians who tested it at Guidonia test center (1° Centro Sperimentale). The aircraft received standard Italian markings and camouflage. It was used in 1942 with British markings during the filming of a propaganda movie *Un Pilota ritorna* (A Pilot Returns) which told a story of an Italian pilot's escape from imprisonment.

Germans captured five Hurricanes in Serbia and one fuselage at Velika Gorica near Zagreb. Two Hurricanes were taken by Luftflotte IV on 24 April 1941. From the five captured aircraft, one was crashed by pilot from II/JG54 and one was torched in the night between 18 and 19 July in Paraćin during a Partisan diversion. Opposite to the other captured aircraft, Germans did not hand Hurricanes over to their new allies, the Croats, but they sold three in the summer of 1941 to Romania (marked locally with s/nos 13-15). Romania purchased spare parts from Rogožarski, which enabled it to increase serviceability of Hurricanes in FARR (*Forțele Aeriene Regale ale României* – Royal Romanian Air Force). Rogožarski factory under German administration (*Werwirtschaftsab Sudost-und Verbindungsstelle der C.L. – Rogožarski*) attempted to sell the unfinished aircraft to German allies including 24 Hurricanes, 18 twin engine floatplanes SIM XIV-H but the sale never materialized. Through the GE Gatarol representative and the Italian military attaché, the Italian air ministry was sent an offer for the delivery of Hurricanes at a cost of 2,201,503 Dinars each. The Hurricane cost included the instruments and the propellers, while the buyer had to source the engines. The use of German DB.601Aa was recommended.

Camouflage and Markings

Type designations

RAF designation Hurricane Mk.I was changed by VV to *Хокер Харикен* (Hawker Hurricane), and sometimes only *Харикен* (Hurricane) was used. This designation was written in large Cyrillic letters on license built aircraft as *ХОКЕР ХАРИКЕН*.

Serial numbers

The first 12, 1st batch imported aircraft, with Hawker construction numbers 205, 206, 291-294 and 312-318 and RAF military serial numbers L1751, L1752, L1837-L1840 and L1958-L1863 respectively, were initially marked in VV as BR.1-BR.12. At the beginning of 1940 these were changed to EvBr 2301-2312. During this year, they carried large codes, Roman numerals (I to XII) painted in White on the fuselage sides which represented the last digits from EvBr.

The second 12, 2nd batch of imported aircraft, with RAF military serial numbers N2718-N2729 were marked in VV with EvBr 2313-2324 and Zmaj Hurricanes from the 1st domestic batch with EvBr 2325-2348. The incomplete 2nd domestic batch of 24 aircraft from Rogožarski was intended to receive EvBr 2349-2372 even though contract Br.97 from 16 March 1939 between VV Headquarters and Rogožarski, indicated that the aircraft were to be marked BR.13-BR.36.

Markings and inscriptions

All Hawker-built machines had factory painted standard peace-time “Kosovo cross” national insignias in four wing positions, while the tail tri-colour flag stripes were not applied on the rudder. White serial numbers (EvBr) were painted on the fuselage sides, in front and below of tailplane leading edge. The port side of the rudder contained White Cyrillic letters (top to bottom) with aircraft type (*ХАРИКЕН*), individual aircraft number (for example BR.12) and aircraft weights in 4 rows.

After the introduction of asymmetric national markings, Hurricanes from 4.LP carried small diameter “Kosovo cross” on the top side of the port wing. The license aircraft had “Kosovo cross” mainly applied asymmetrically as well but opposite to the usual method (which appears to be the approach by Zmaj factory), with marking applied on the topside of the starboard wing and bottom side of the port wing. Some license built aircraft did not carry markings on the top side at all. The standard war flag (Blue/White/Red tricolour tail stripes from top to bottom) was placed at the top of the rudder and it only partially crossed over to the vertical stabilizer. Cyrillic writing was applied at the factory in accordance with the new standard, in Yellow colour on both sides of the rudder in separate rows: type (*ХАРИКЕН*), twice as large letters

Fine shot of captured VV Hurricane at Beograd Airport after the war (Ruy Alexandre Aballe Vieira via Aleksandar Ognjević)



EvBr (for example BR.2347) and below it the aircraft weights in four rows. Some aircraft only had the abbreviations of the aircraft weights without any weight values.

Camouflage schemes

All Hurricanes imported from the UK were factory painted according to the RAF standard (Temperate Land Scheme, for use in moderate climates), with irregular patches of Dark Green and Dark Earth on the upper surfaces. Two camouflage schemes existed, Scheme "A" and Scheme "B". The first was applied to the aircraft with odd serial numbers and the second to those with even. The Scheme "A" fields were placed mirrored to the Scheme "B", while colours were reversed. The first 12 aircraft (EvBr 2301-2312) had Silver under surfaces while the second batch (EvBr 2313-2324) had the Black and White undersides according to the contemporary RAF manner. The port wing was painted Black the starboard White, while the rest of the under surfaces were Aluminium. During repairs, some of these imported Hurricanes had their undersurfaces repainted in Light Blue Grey.

Zmaj-built Hurricanes (EvBr 2325-2348) were factory painted in a new VV three colour camouflage scheme, similar to that on IK-2 and IK-3 fighters, with Ochre Yellow, Dark Green and Dark Brown with irregular patches on the upper surfaces. The undersides were painted with Light Blue Grey. This colour covered at the sides of the fuselage and the vertical stabilizer, which was the opposite of RAF practice.

All Hurricanes had the propellers painted Black with Yellow tips in the manner inherited from the RAF.

| Aircraft Characteristics Hawker Hurricane Mk. I (Merlin II, Watts Z.38 propeller)* | |
|--|---|
| Quantity used: | 12 (1 st imported batch) |
| Crew: | 1 |
| Years of Service: | 1938–1941 |
| Span: | 12.2 m (40.0 ft) |
| Length: | 9.3 m (30.6 ft) |
| Height: | 4.0 m (13.2 ft) |
| Wing area: | 23.9 m ² (258 ft ²) |
| Engine:* | One 1,044 mhp (1,030 hp) Rolls-Royce Merlin II |
| Empty weight: | 2,151 kg (4,743 lb) |
| Maximum weight: | 2,820 kg (6,218 lb) |
| Maximum speed: | 491 km/h (305 mph) at 5,182 m (17,000 ft) |
| Cruise speed: | 360 km/h (224 mph) |
| Initial climb: | 12.7 m/s (41.7 ft/s) at sea level |
| Service ceiling: | 9,144 m (30,000 ft) |
| Absolute ceiling: | 10,668 m (35,000 ft) |
| Maximum range: | 845 km (525 ml) |
| Armament: | Eight 7.9 mm M.38 (FN Browning) machine guns in wings |

* Merlin II and Watts Z.38 gradually replaced with Merlin III and DH propeller.

| Aircraft Characteristics Hawker Hurricane Mk. I (Merlin III, DH 5 propeller) | |
|--|---|
| Quantity used: | 12 (2 nd imported batch) |
| Crew: | 1 |
| Years of Service: | 1940–1941 |
| Span: | 12.2 m (40.0 ft) |
| Length: | 9.6 m (31.3 ft) |
| Height: | 4.3 m (14.2 ft) |
| Wing area: | 23.9 m ² (258 ft ²) |
| Engine: | One 1,044 mhp (1,030 hp) Rolls-Royce Merlin III |
| Empty weight: | 2,283 kg (5,034 lb) |
| Maximum weight: | 2,947 kg (6,498 lb) |
| Maximum speed: | 521 km/h (324 mph) at 5,425 m (17,800 ft) |
| Cruise speed: | 360 km/h (224 mph) |
| Initial climb: | 13.0 m/s (42.6 ft/s) at sea level |
| Service ceiling: | 9,479 m (31,100 ft) |
| Absolute ceiling: | 10,790 m (35,400 ft) |
| Maximum range: | 845 km (525 ml) |
| Armament: | Eight 7.9 mm M.38 (FN Browning) machine guns in wings |

| Aircraft Characteristics* Zmaj-built Hurricane Mk. I (Merlin III, DH 5 propeller) | |
|---|---|
| Quantity used: | 24 (1 st domestic batch) |
| Crew: | 1 |
| Years of Service: | 1941 |
| Span: | 12.2 m (40.0 ft) |
| Length: | 9.5 m (31.3 ft) |
| Height: | 4.0 m (13. ft) |
| Wing area: | 24.0 m ² (258 ft ²) |
| Engine: | One 1,044 mhp (1,030 hp) Rolls-Royce Merlin III |
| Empty weight: | 2,109 kg (4,650 lb) |
| Loaded weight: | 2,808 kg (6,191 lb) |
| Maximum weight: | 2,896 kg (6,386 lb) |
| Maximum speed: | 522 km/h (324 mph) at 5,340 m (27,520 ft) |
| Climb to 5,000 m: | 7 min 12 s |
| Climb to 6,000 m: | 9 min 34 s |
| Service ceiling: | 9,150 m (30,020 ft) |
| Maximum range: | 716 km (445 ml) |
| Endurance: | 4 h 24 min at cruising speed of 273 km/h (170 ml) |
| Armament: | Eight 7.9 mm M.38 (FN Browning) machine guns in wings |

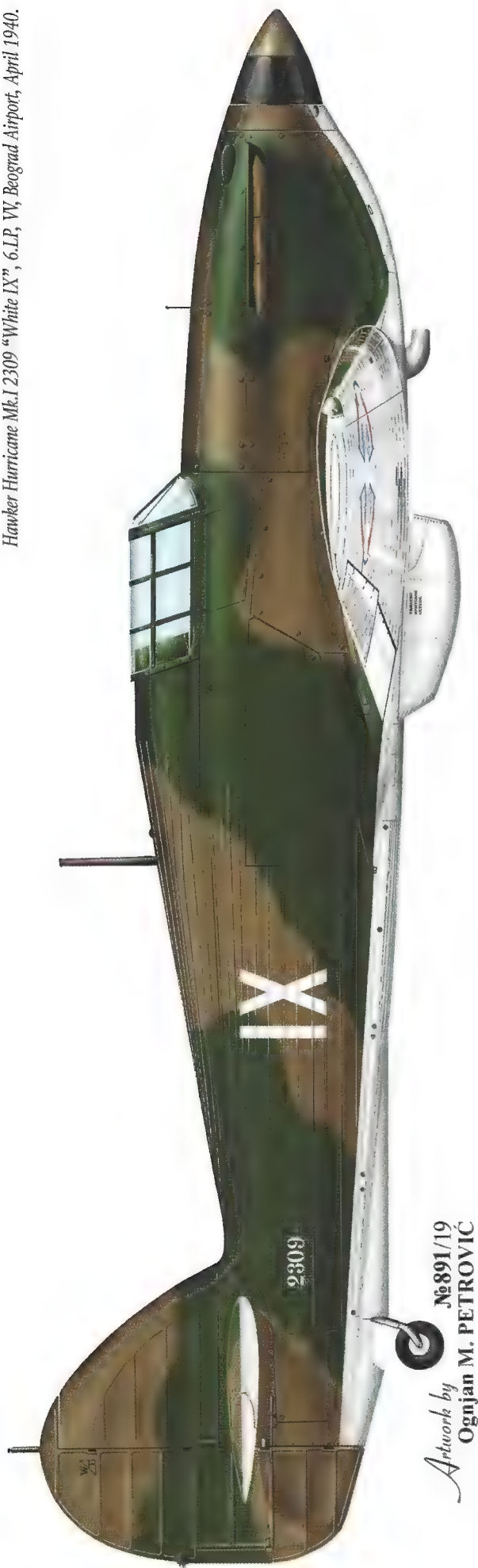
* Specification according contract V.M.T. br. 5529/II from 31 March 1939 concluded between VV HQ and Zmaj A.D.

| Aircraft Characteristics Rogožarski-mod LVT-1 (Hurricane DB) | |
|--|---|
| Quantity used: | 1 conversion |
| Crew: | 1 |
| Years of Service: | 1941 |
| Span: | 12.2 m (40.0 ft) |
| Length: | 9.55 m (31.3 ft) ± 2% |
| Height: | 4.07 m (13.4 ft) ± 2% |
| Wing area: | 23.9 m ² (258 ft ²) |
| Engine: | One 1,100 mhp (1,085 hp) Daimler Benz DB.601Aa |
| Empty weight: | 2,200 kg (4,851 lb) |
| Maximum weight: | 2,855 kg (6,295 lb) |
| Maximum speed: | 531 km/h (330 mph) |
| Cruise speed: | 360 km/h (224 mph) |
| Initial climb: | 13.3 m/s (43.6 ft/s) |
| Service ceiling: | 11,000 m (36,100 ft) |
| Maximum range: | 845 km (525 ml) ± 2% |
| Armament: | Eight 7.9 mm M.38 (FN Browning) machine guns in wings |

Interesting scene at Beograd Airport, pictured after the 1941 April War: captured Zmaj-built Hawker Hurricane (most probably 2328) without engine cowlings and an early model Luftwaffe Heinkel He 111 parked side by side. Note the “Kosovo cross” on the upper surface of Hurricane’s starboard wing. German machine is seen still carrying the yellow rudder painted for the Balkan campaign. (Nenad Mikušev)



Hawker Hurricane Mk.I 2309 "White IX", 6.LP, VV, Beograd Airport, April 1940.



Starboard side profile of the 9th machine from the first 12 imported Hurricanes (VV shos 2301-2312), known as 1st batch Hurricane in the VV. Early types of windshield and radio-mast, fabric covered wings and two-blade Watts propeller were features of the 1st batch aircraft. Note the absence of antenna wire.



VV Exhibition at Beograd Airport, 27 April 1940. There were five Hurricanes in the line up: (left to right) "White I", "White IX", "White III", "White X" and "White VIII". Hurricane "White IX" wearing the RAF Scheme "A". Note "White XI" in the background. (City of Belgrade Library)

Hawker Hurricane Mk.I 2309 "White IX".
Port side view shows difference in relation to the starboard side.



Artwork by
Ogujan M. PETROVIĆ
№879/19

Newly introduced VV s/nos (EvBr 2309) 10 cm tall and 50 cm tall Roman numerals codes (IX) were applied in White colour on the fuselage sides. Also new tail inscriptions (six rows in Serbian Cyrillic), only on the port side of rudder, were introduced on Hurricanes of the 1st batch: aircraft type (ХОКЕР ХАРИКЕН – HAWKER HURRICANE), VV s/n (Бр.2309) and four aircraft weights. The Hurricane was the first VV type which introduced this kind of tail inscriptions, the second was Me-109.

VV rudder inscriptions detail.



Seven Hurricanes Mk.I's from the first imported batch are seen here, including the "White V", "White VII" and "White IX". All propellers are in the start position. (Aviation Museum – Belgrade)

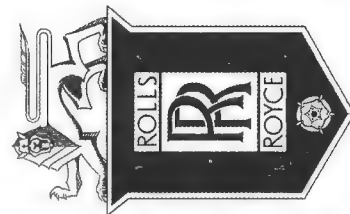


Early Hawker logo.



Plan views of Hurricane Mk.I 2309 "White IX" with fabric wing structure clearly visible. The machine carried RAF Scheme "A" camouflage patterns on the upper surfaces.

Four standard WW "Kosovo cross" insignias were strictly applied by Hawker at the same positions and with the same diameter (45 in = 114.3 cm) as those on RAF Hurricanes.



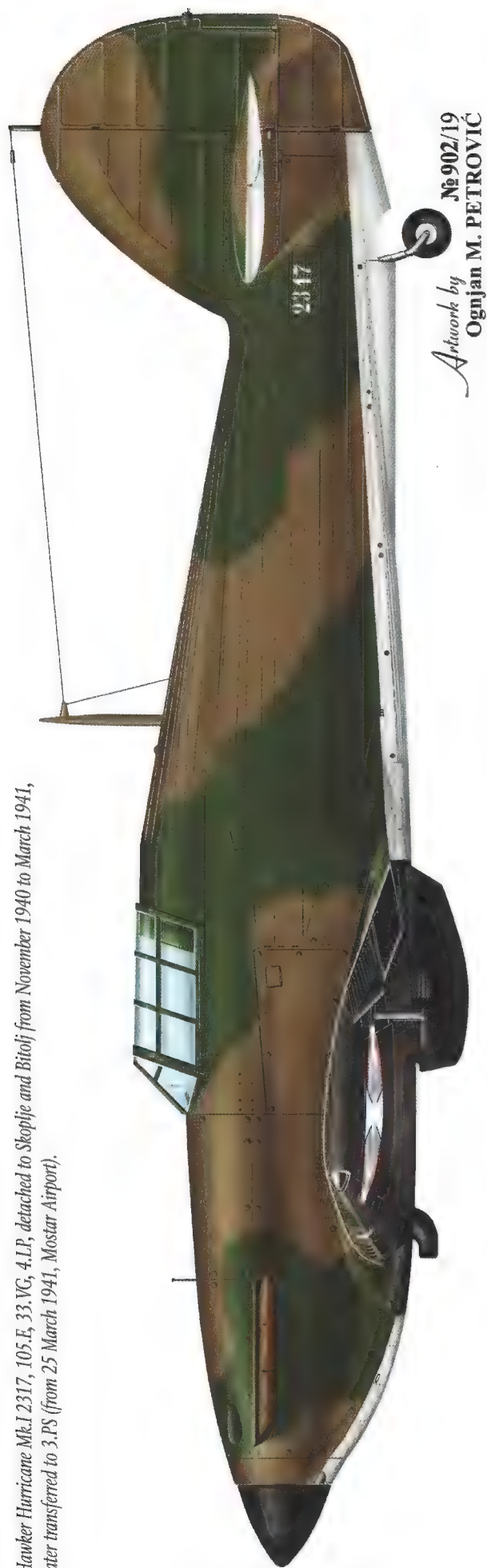
Rolls-Royce logo.

Artwork by
Ognjan M. PETROVIC
№899/19



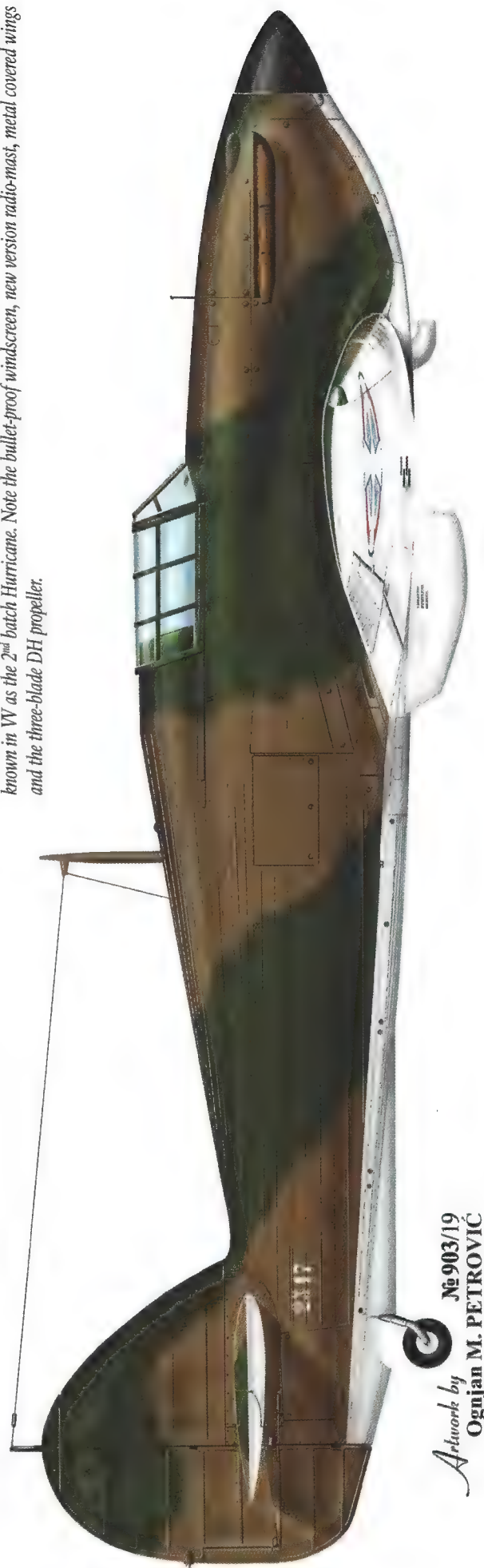
All Hurricanes from the 1st imported batch from the UK in 1939 were factory painted according to the RAF standard of that period, with standardized patches of Dark Green and Dark Earth on the upper surfaces and Silver on the under surfaces. The two-tone upper camouflage is applied in two variations known as RAF Scheme "A" and Scheme "B", which formed, one against the other, mirror views.

Hawker Hurricane Mk.I 2317, 105.E, 33.VG, 4.LP, detached to Skoplje and Bitolj from November 1940 to March 1941, later transferred to 3.PS (from 25 March 1941, Mostar Airport).



Artwork by
№902/19
Ognjan M. PETROVIĆ

Profile views of the 5th machine (2317) of twelve Hurricanes (VV s/nos 2313-2324) imported in 1940, which remained known in VV as the 2nd batch Hurricane. Note the bullet-proof windscreen, new version radio-mast, metal covered wings and the three-blade DH propeller.



Artwork by
№903/19
Ognjan M. PETROVIĆ

The Hurricane 2317 wore Hawker factory applied RAF Scheme "B" camouflage. Note the absence of codes on 2nd batch machines.

Upper and under views of metal-winged Hurricane 2317 clearly show RAF Scheme "B" camouflage on upper surfaces and Black-White under surfaces of wings which introduced by RAF shortly after the Munich crisis. The form of Black-White under wing scheme applied on 2317 (with Silver doped fuselage and tail plane undersides) was one of several variants of such camouflage used by the RAF.

All RAF-style factory applied stencils were retained. The spinner was Black on all 2nd batch Hurricanes.

Artwork by
Ognjan M. PETROVIC
№901/19

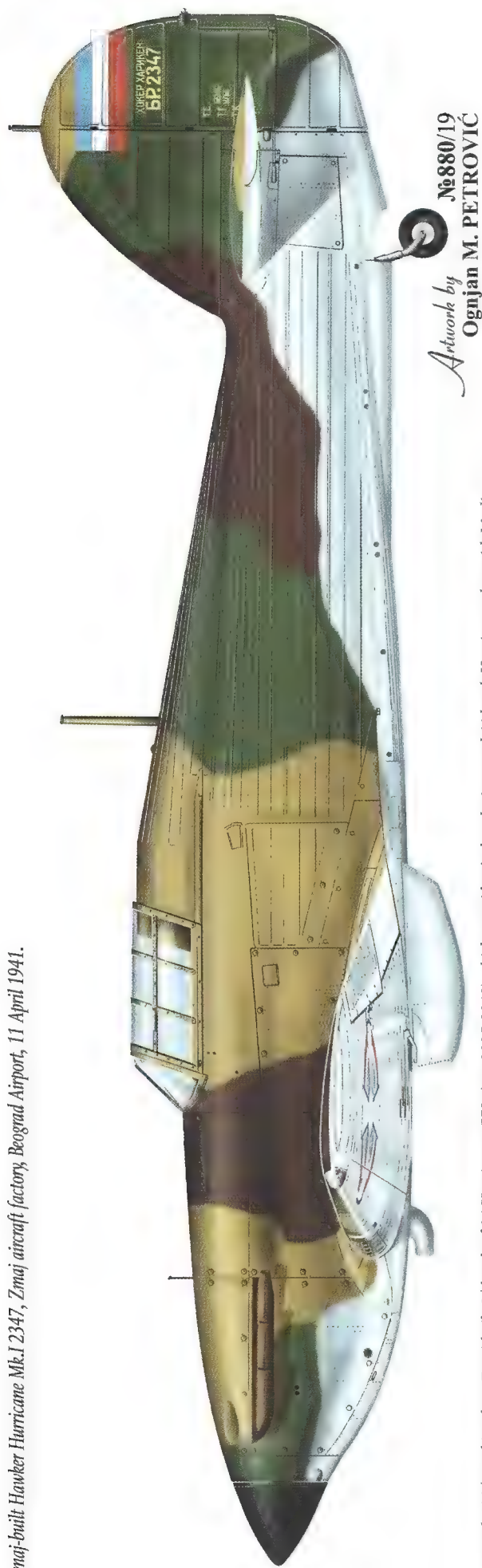


Artwork by
Ognjan M. PETROVIC
№898/19



Three WW officers during a conversation next to the tail of Hurricane 2317 from 3 PS at Mostar Airport on 25 March 1941. The first from the left is avrč Ilk Vicko Krelija, the second is kap Ilk Milan "Mak" Bjelanović, the third is av Ilk Dimirije Tot. (Robert Čopac)

Hawker applied four "Kosovo cross" insignias remained at the same positions and with the same diameter as RAF roundels (45 in = 114.3 cm). Note that the under side insignias were moved towards the fuselage.



It was the 23rd machine from Zmaj-built 3rd batch of 24 Hurricanes (VV shos 2325-2348) which were identical to the imported 1st batch Hurricanes, but with Merlin III engines and Rogožarski U-21 propellers.

VV rudder inscriptions detail on Zmaj-built machines.

Hurricane 2347 at Beograd Airport apron, after the April War 1941. Note the absence of antenna wire on this machine. (Jan van den Heuvel)



Plan views of 2347, a Zmaj-built Hurricane, which was factory painted in new three-tone camouflage scheme particular to license built machines with Ochre Yellow, Dark Green and Dark Brown colours with irregular patches on the upper surfaces while the undersides were painted with Light Blue Grey.

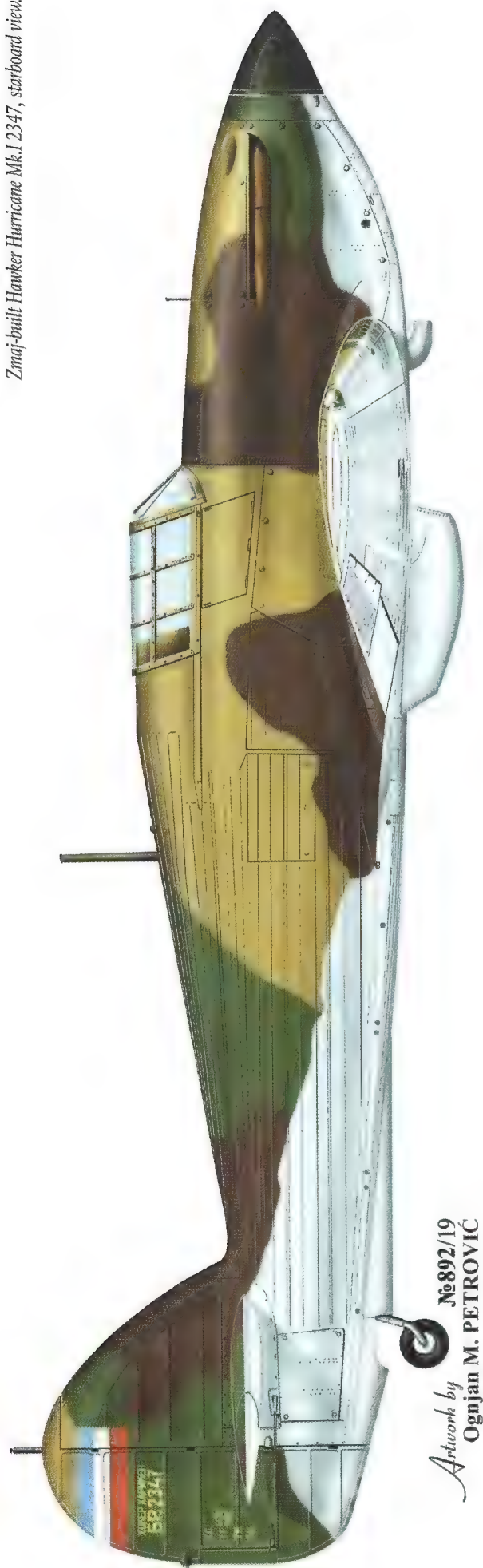


Newly introduced, two position asymmetric VW "Kosovo cross" insignias, were applied by Zmaj mainly according to its own practice. These factory applied asymmetric wing insignias on its aircraft were opposite of the official VW rules, with the small one (75 cm diameter) on the upper surface of the starboard wing and the larger one (100 cm diameter) on the under surface of the port wing.

Zmaj logo with title Zmaj A.D. Zemun. Some Zmaj-built aircraft had White logo factory applied on vertical tail fabric cover. That is rarely seen on the photos but such artifact is saved in a private collection.



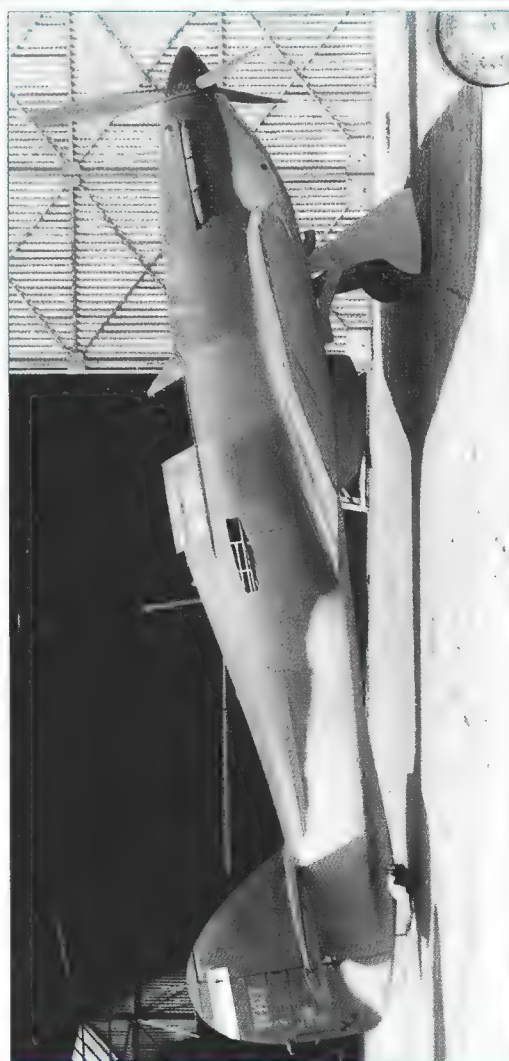
Zmaj logo without title.



Newly adopted tail stripes, the so called "small war flag" (30 cm tall) was painted on license-built VV Hurricanes. The Zmaj aircraft factory introduced slightly different tail inscriptions (on both sides of the rudder) in Yellow colour on its machines. Note the absence of aircraft weights on this machine, still undelivered to a VV unit.

Zmaj-built Hurricane 2347 was captured at Beograd Airport. It was damaged on 11 April and as such could not transfer with the other aircraft to Veliki Radinci auxiliary war airfield. (Petar Bosnić)

Another shot of 2347 at Beograd Airport in a line up with the rest of the captured VV aircraft. Note the damaged fabric skin below the cockpit and the absence of main undercarriage wheels. (Zoran Jerin via Čedomir Janić)



Rogožarski IK-3

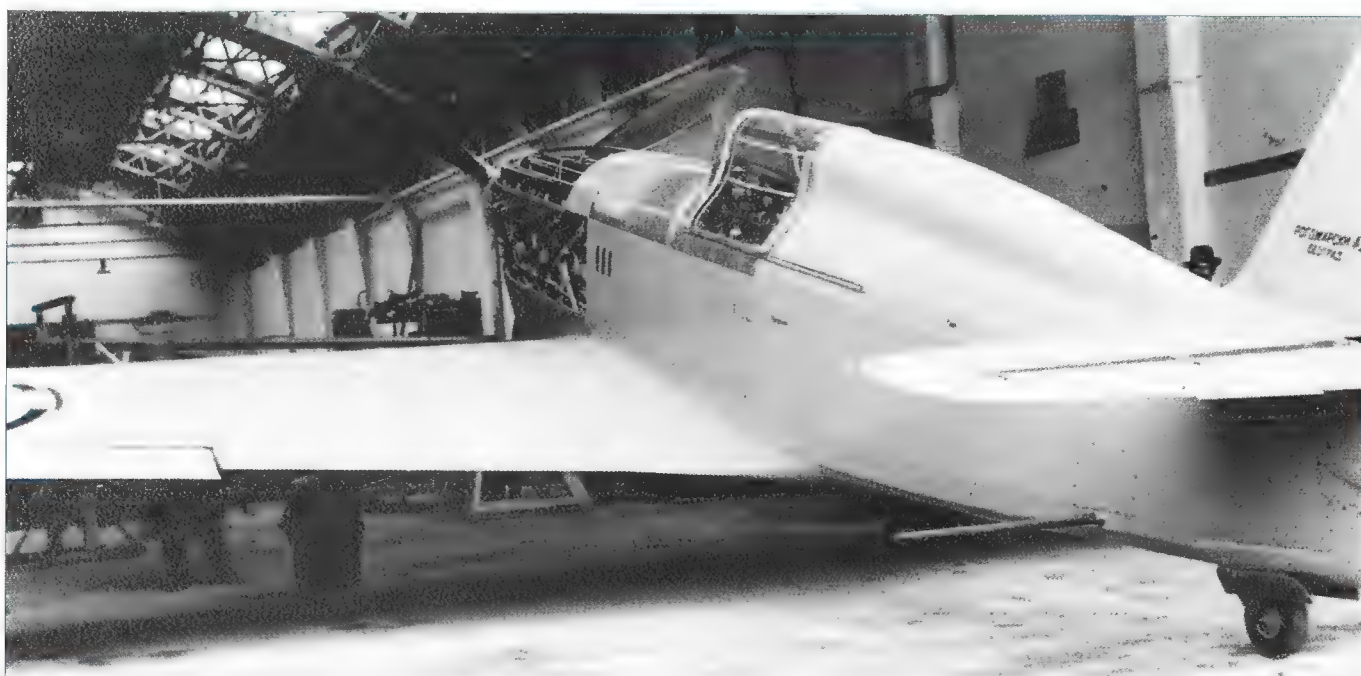
Background

Encouraged by the IK-2 development, designers Ljubomir D. Ilić and Kosta I. Sivčev, along with another French scholar, Slobodan J. Zrnić, who joined the team early in the design phase, were convinced that the era of biplanes and the high-wing monoplanes had come to an end. Considering the high-quality performance of new bombers under development at the time, only low-wing monoplanes with retractable landing gear possessed the characteristics necessary to guarantee air supremacy. One of the top requirements set by the designers was exceptional maneuverability. The new aircraft was a compromise between French influence in aircraft design and British and German modern fighter concepts. A joint venture contract between the three designers was signed specifying the share each held with regards to the new fighter design. Ilić held 50% and Sivčev and Zrnić 25% each of the intellectual property related to the IK-3 project. Ljubomir Ilić was responsible for aerodynamic calculations, Kosta Sivčev for equipment selection, ailerons and tail surfaces and Slobodan Zrnić for fuselage cross sectional profile and framing, wing profile, wing to fuselage joints and engine installation.

Following the completion of the necessary calculations and the initial sketches, a wooden model in 1:10 scale was made in 1936 at the carpentry workshop of Rogožarski A.D. in Belgrade. This model (with assigned designation I.K. № 3) was tested at the Eiffel wind tunnel in Paris on 16 March 1936. Following the completion of wind tunnel testing, data obtained was evaluated resulting in a revision of the design calculations, which led to the aft fuselage lengthening by 20 cm, which improved longitudinal stability.

The French Hispano Suiza 12Y-29, the newest version of famous French aero-engine family, was selected by the designing team to power the new fighter. This water-cooled 12-cylinder Vee piston engine, equipped with gear (2:3) and HS supercharger (10:1), rated 910 mhp (898 hp) at take-off, 810 mhp (799 hp) nominal power at sea-level, and 920 mhp (907 hp) continuous power at 2,600 rpm at 3,000 m. The

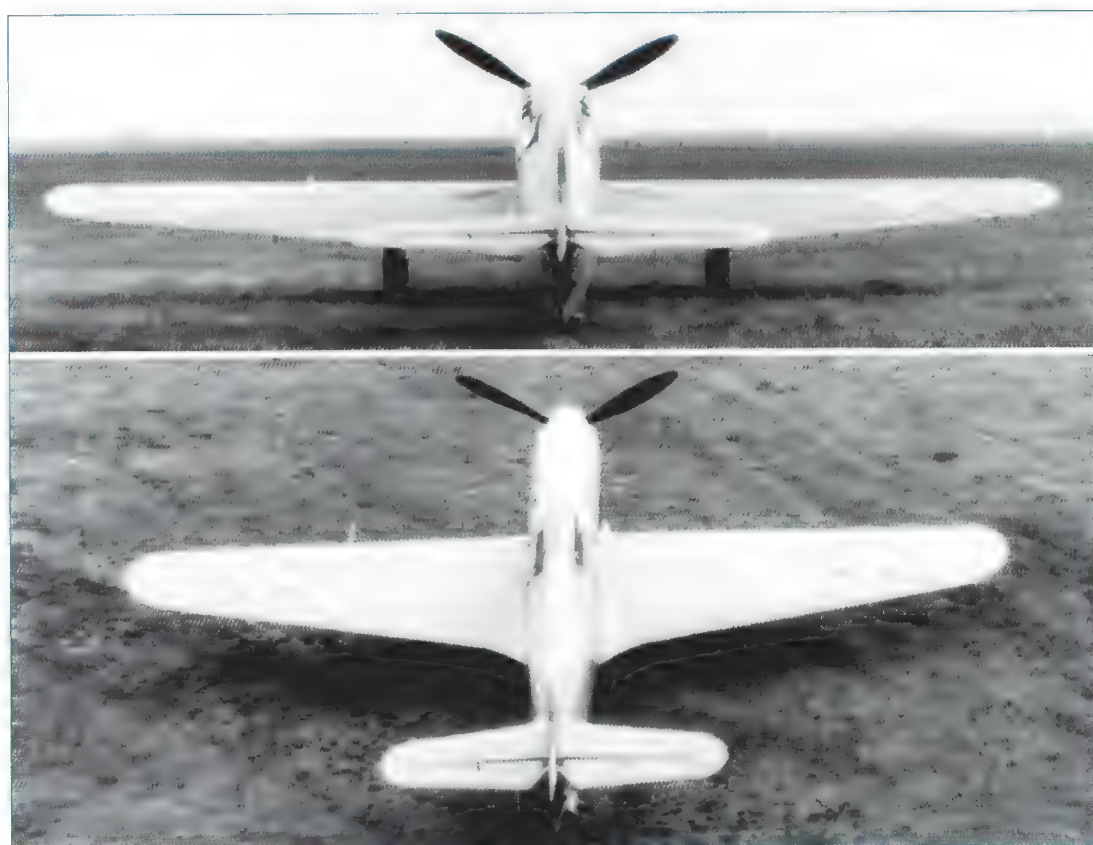
Aft view of the IK-3 Br.1 at Rogožarski A.D. factory sometime in April 1938 prior to its first flight. (Mario Hrelja)



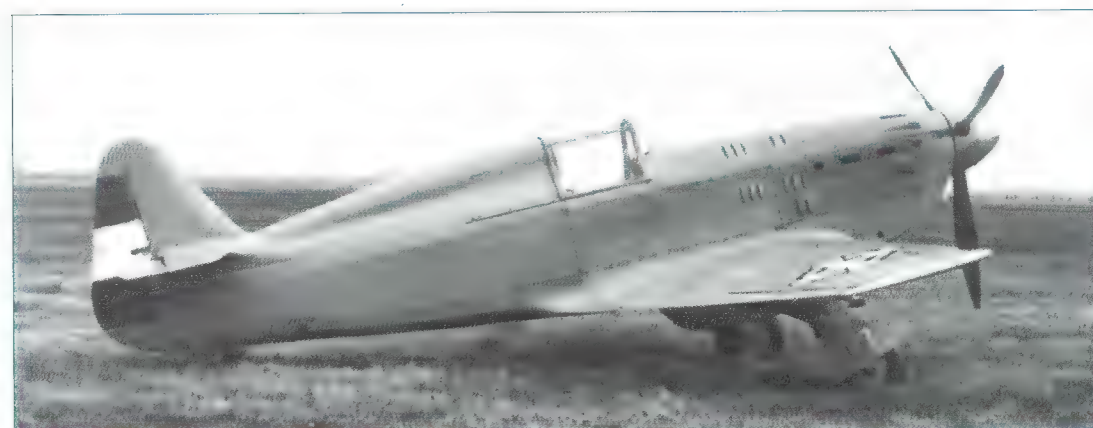
IK-3 Br.1 warming up its engine prior to another test flight. (Aviation Museum – Belgrade via Nenad Miklušev)



Two fine aft shots of Br.1 at Beograd Airport. This machine was painted overall in Light Grey-Green color of French origin and had VV "Kosovo cross" insignia in four positions on top and bottom wing surfaces (both Aviation Museum – Belgrade via Aleksandar Ognjević and Nenad Miklušev)



IK-3 Br.1 showing the curved windshield which proved so troublesome it was changed on the first production batch aircraft. (Aviation Museum – Belgrade via Nenad Miklušev)





Model of the IK-3 was displayed by the Rogožarski A.D. at the First International Aeronautical exhibition in Belgrade between 28 May and June 1938. The actual aircraft was stored in a hangar during the event, to avoid attention from the visiting foreign delegations. (Aviation Museum – Belgrade)

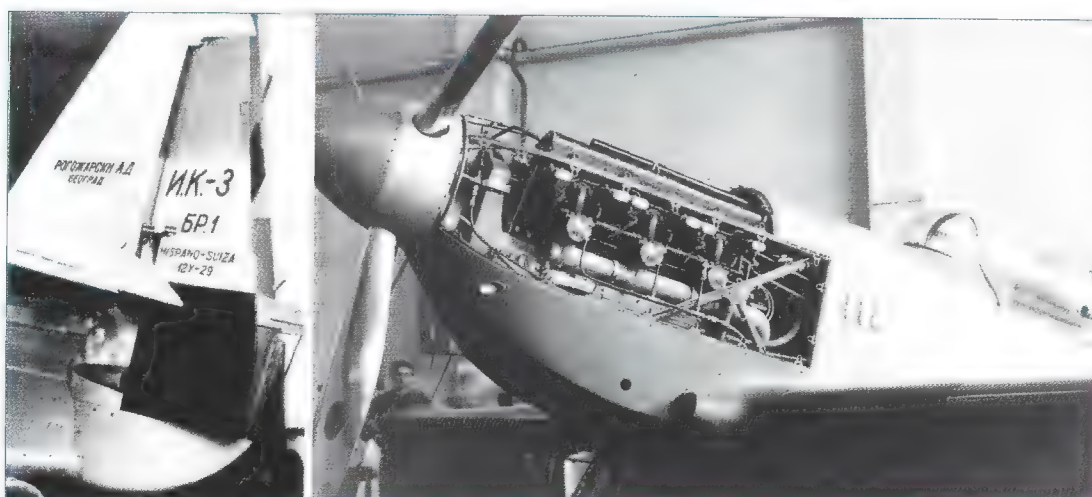
problem was that no production aircraft in the country of origin, France, had flown yet with this engine type, which added some risk to the entire project.

The project documentation was handed over to the military authorities for review in mid-1936, with the prototype drawings following the next year. Due to the skepticism concerning the new design approach from the conservatives involved in the process, the authorities' initial project review took too long. Finally, on 31 March 1937 the contract was signed to produce a single prototype with work assigned to the Rogožarski A.D. A wooden mock-up was constructed and a Hispano Suiza 12Y-29 engine s/n (№) 495177, along with other equipment, was installed to test fit and layout the equipment prior to commencing work on the actual prototype.

The first prototype

The first prototype, №1 (later Br.1), was completed in the beginning of April 1938 at the Rogožarski A.D. prototype workshop. The completed prototype was unarmed although it contained all the necessary weapons installations. It made its first flight on 14 April 1938 with the Rogožarski A.D. factory test pilot *kap II* Milan V. Bjelanović at the controls. Following ground checks, the aircraft took off with ease, reaching 1,000 m altitude and landing not long thereafter. By the end of the summer 1938, all factory testing came to an end and the IK-3 prototype was handed over to VOG at Beograd Airport with the intent to accumulate a total of 100 flight hours. The presence of the prototype was a closely guarded secret and when not flying, the prototype was moved to the VOG's hangar out of public sight. This was especially the case during the First International Aeronautical Exhibition in Belgrade between 28 May and 13 June 1938 when many foreign delegations passed through the busy Beograd Airport.

Following the successful completion of all test flights, the prototype was officially handed over to 6.LP on 18 January. The first flight by *puk* Dragutin Rupčić the next day, 19 January, ended with a rough landing, which prompted a precautionary inspection by Rogožarski engineer on site. Having found no



IK-3 prototype Br.1: (left) The rudder was painted with a large Blue-White-Red Yugoslav flag and had the aircraft designation, aircraft number written in Cyrillic letters, and engine type in Latin. The factory name was written on the vertical stabilizer; (right) A port side view shows removed engine cowling and the first type of windshield and canopy. (both Aviation Museum – Belgrade via Nenad Miklušev)

On 19 January 1938 kap Ik Milan Pokorni crashed IK-3 Br.1. Note the "Kosovo cross" insignia on the remaining wing section.
(Military Archive – Belgrade via Predrag Miladinović)



visible damage, the aircraft was cleared to continue flying. Not long thereafter *kap Ik* Milan Pokorni took off and following a routine flight program he went in a dive from an altitude of 1,500 m over the airport. While diving the canopy broke off startling the pilot who intuitively pulled on the control column too suddenly. The wing broke off at 300 to 500 m altitude and the machine started spinning uncontrollably hitting the ground at tremendous speed which killed the pilot. The committee responsible for investigating such accidents could not conclusively determine the root cause of the accident and attributed it to serious structural problems or pilot error. Verification of design calculations by French and German advisers and static wing load testing to a factor of 14.5, which far exceeded the requirements, confirmed the soundness of the wing design. As a result, it is believed that the accident was most likely caused by the hard landing by *puk* Rupčić weakening the front wing spar. Nonetheless, this event and the precautionary changes delayed the start of production. Additional precautionary changes were proposed by the factory such as canopy design to ensure it is secure at all speeds and elevator sensitivity adjustment to enable pilot to feel the forces on the control column better while diving.

The prototype was armed with 7.7 mm M.30 (Darne 1930) machine guns with 250 rounds per gun. An older Hispano Suiza S.9 cannon with 60 rounds per gun purchased just for this purpose but there is no proof it was installed since the spinner lacked a muzzle port. Gun-sight was standard Collimateur Chrétien E.T.Aé Modèle 1933 license-manufactured by Teleoptik while the proposed radio receiver-transmitter was German Telefunken FuG VIIa.

Series production

Contract for the first batch of six production IK-3 fighters was signed on 26 November 1938 with the intended delivery date of December 1939. VOG from Beograd Airport was to again perform the evaluation prior to acceptance into service and compare performance to that of the prototype.

Compared to the prototype, a total of 57 improvements were implemented. Instead of the Hispano Suiza HS 404 cannon, which could not get on order any longer due to the situation in France, Swiss

IK-3 Br.2 (later 2151) at the snow covered Beograd Airport on 15 December 1939 during the official hand off following completion. From right to left are engineer maj Ljubomir Ilić, engineer Jovan Kovačević, maj Janko Markićević and kap Ik Miodrag "Brege" Blagojević.
(Milan Micevski)





With its engine running IK-3 Br.2 is getting ready for take off. (Aviation Museum – Belgrade via Nenad Miklušev)

Oerlikon FFS/MK (Yugoslav designation M.39 E.M) was installed. Changes were also implemented to the windshield and canopy, as desired by the test pilots to improve visibility. All these changes resulted in a weight increase of 111 kg, which reduced the maximum speed at utilization altitude from 524 km/h to 520 km/h.

The first aircraft to be completed on 15 December 1939 was 2151/2 and the first flight conducted on 24 December with factory test pilot *kap II* Milan Bjelanović at the controls lasted nine minutes and was a major success. Following the successful completion of 12 factory test flights lasting 8.1 hours, 2151/2 was handed over to VOG, where it completed an additional 25 flights lasting 9.23 hours. The remainder of the aircraft on order, 2152/3 through 2156/7 were completed by 18 April 1940 and were undergoing trials with the Hispano Suiza 56 Constant Speed propellers (licensed from Hamilton Standard) while 2157/8 through 2162/13 waited for the *Chauvière* 351M propellers to be delivered and installed, as they needed to clear customs.

On 17 April 1940 a general strike by the employees of the aeronautical industry came into effect in Belgrade and lasted three long months. As a result, the completion of the last six fighters from the first batch prolonged until 8 July 1940. Finally, on 8 July 1940 brig *đen* Borivoje J. Mirković issued an order to equip the 51.VG entirely with IK-3.

Two shots of a line up of VV fighter and bombers on 27 April 1940 during the Air Force Aircraft and Weapon Exhibition at Beograd Airport: (top) From right to left, Fieseler Fi-156C-2 Storch Br.7, IK-3 Br.2 (later 2151), Me-109 L-75, Hurricane 2306 "White VI", Bristol Blenheim and Savoia-Marchetti SM-79; (bottom) Bücker Bu-131D-2 Br.623 trainer is in the foreground, while the same aircraft are parked next to it. (City of Belgrade Library via Predrag Miladinović)



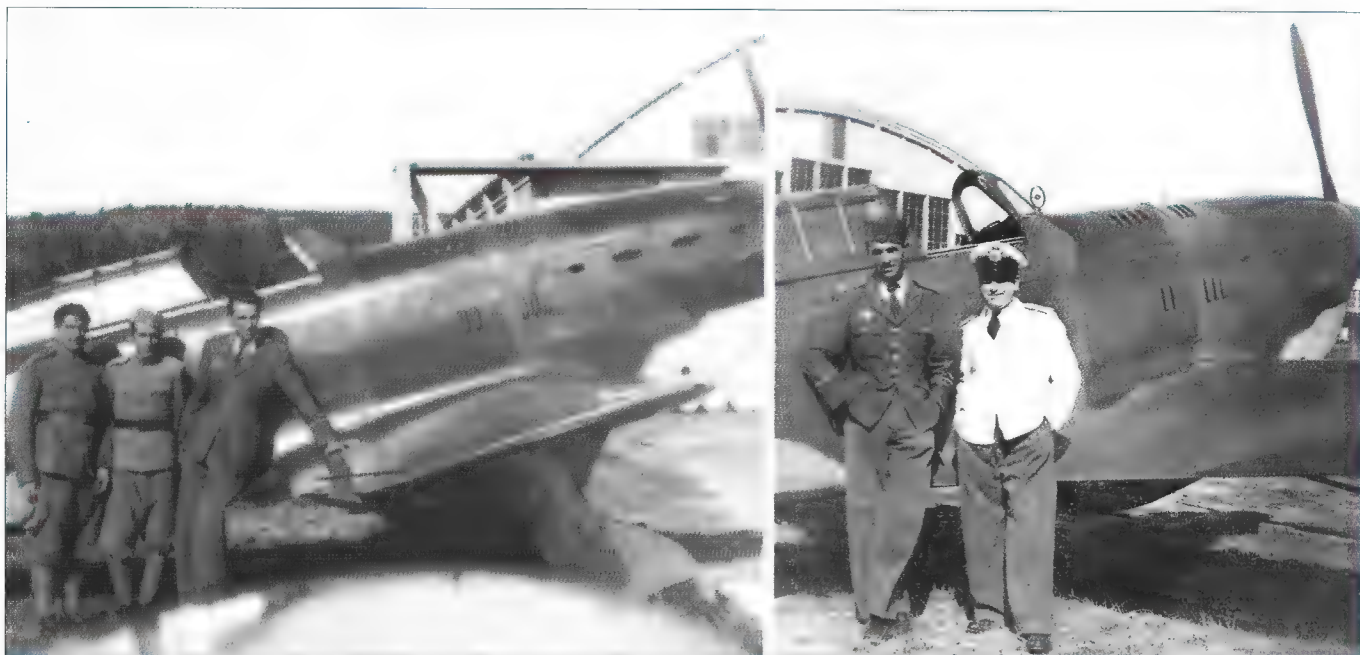
51.VG ground crews posing in front of an IK-3 at Beograd Airport in October 1940. Behind the IK-3 is SM-79 "Black 3" bomber from 81.VG. Note the hub-firing experimentally fitted M.38 machine-gun muzzle, twin Yellow bands and Hispano-Suiza logo on the propellers. (Aviation Museum – Belgrade via Aleksandar Ognjević)



Three IK-3s are visible in another photo taken at Beograd Airport in October 1940. Two are carefully inspected by curious onlookers while one is in a hangar. 81.VG's SM-79 "Black 14" is parked in the background. Note the absence of EvBr above the rudder flag which was later added. (Vukašin Aleksijević family via Igor Čerņisevski)

While landing following a mock dogfight with a VV Me-109 in June 1940, IK-3 2152 (Br.3) suffered the starboard main landing gear collapse. The aircraft was piloted by kap Ik Sava Poljanec at the time. Note the fresh semi-gloss paint coats and the absence of EvBr on the fuselage side and Rogožarski logo and title on the vertical stabilizer. (Milan Micevski)





During the comparison flight testing in 1940 against the Hawker Hurricane Mk.I and the Messerschmitt Bf 109E-3a (VV Me-109), Rogožarski IK-3 proved superior compared to the Hurricane and also had a tighter turn radius than the Bf 109. During the mock dogfights where *kap Ik* Sava Poljanec flew the IK-3 2152/3 and *резервни официр* (Pilot Officer in reserve) and an engineer Boris Cijan the Me-109, it was determined that the Messerschmitt fighter performed better in vertical maneuvers, had a higher rate of climb and higher speed, but the IK-3 had a tighter turn radius of 260 m versus 320 m respectively.

12 series IK-3 fighters were powered with the same engine used on the prototype. Weapons consisted of one 20 mm M.39 E.M. (Oerlikon FFS/MK) *moteur-canon* with 60 rounds and two 7.9 mm M.38 (FN Browning) with 500 rounds per gun. Gunsight was the same as on the prototype, oxygen inhalator was Teleoptik M.38. Predicted Telefunken FuG VIIa radio sets was installed on Br.2 only.

To substitute imported components and parts, Rogožarski produced 11 spare propellers of which the first sample was delivered on 31 March 1941 to 51.VG to replace a damaged propeller on one of the aircraft.

First service year

The first six aircraft, 2151/2 through 2156/7, were delivered by 26 April 1940. According to the official report submitted to the Minister of Army and Navy, the remaining six aircraft, 2157/8 through 2162/13, were to be delivered at the end of April 1940 but were delayed and instead delivered by 8 July 1940. Once in service, the IK-3s were allocated to 1.LB 6.LP, 51.VG comprised of 161.E and 162.E. A few days later, on 11 July, 51.VG became an independent unit, detached and under the direct command of the 1.LB CO *puk* Rupčić. The IK-3s were based at Beograd Airport for a specific reason; their landing gear was sensitive to uneven airfield surface and required a long take off run, and moreover to the pilots who were not familiar with using the breaks.

One IK-3, 2155/6, was lost on 3 September 1940, killing *kap Ik* Anton Ercigoj, the pilot of 51.VG and a member of the famous VV Aerobatic Trio (with *kap Ilk* Sava Poljanec and *kap Ilk* Kosta Lekić). During the mock attack training with a Potez 25 over the Sava and Danube rivers estuary, he went into a steep climb with an intention to loop the aircraft but stalled at low altitude and hit the water. A possible cause of the crash was pilot's error due to fatigue, as Ercigoj performed almost an hour-long aerobatics flight on Rogožarski P.V.T. trainer just before this fatal flight.

The IK-3 modern low wing fighter was the best product of Serbian (Yugoslav) aeronautical industry and represented its pinnacle. Its performance at the time ranked among the best in the world, entirely at the level of British and Germans fighters of the time period, which it even surpassed in some aspects. Unfortunately, its early appearance was not used due to the slow production technology which was not appropriate for series production and due to inability to secure the supply of engines. The slow production technology had similar effect with the production of French MS.406C-1 fighter, however France could organize production in many factories. Those two reasons led the VV HQ to not adopt IK-3 as a standard fighter type until the second half of 1940.

Ppor Dušan R. Borčić in front of IK-3 fighter: (left) with two fellows, standing on the right (Malcolm Passingham via Aleksandar Ognjević); (right) with unknown officer, standing on the left (Aviation Museum – Belgrade via Aleksandar Ognjević). Three tone camouflage scheme is clearly visible. Note the camouflage pattern and the demarcation on the nose between the top and bottom colours.



A newly applied, Hurricane like, windshield and rear sliding canopy offered superior pilot's visibility (Mario Hrelja)

The IK-3 was officially described by VV in 1940 as: „једномоторни једносед за борбу са мотором Хиспано Суиза 12Y-29 од 925 КС на 3600 метара и 2400 обртаја у минути” i.e. “single-engine single-seat fighting aircraft powered by 925 mhp Hispano Suiza 12Y-29 at 3,700 m and 2,400 rpm”.

Second batch

Arm đen Dušan T. Simović, Chief of the General Staff of the Royal Yugoslav Army, announced on 11 January 1939 that by the end of 1939 12 IK-3s will be in service and a total of 48 by the end of 1940. The plans to make an additional 36 IK-3s did not come to fruition because sufficient quantities of Messerschmitt Bf 109E-3a from Germany and Hawker Hurricane Mk.I built under license were secured. Additionally, sourcing engines abroad proved troublesome.

Rogožarski A.D. initiated the proposal for the development and the delivery of the second batch of IK-3 on own accord, which was submitted to the VV Headquarters (Štab Vazduhoplovstva vojske) on 25 March 1940. This proposal included two options; one for 50 additional aircraft to be completed in 11 months or 25

aircraft to be completed in nine months. Rogožarski A.D. submitted the final offer on 14 November to the VV HQ with the delivery date of 12 months. The final list of changes submitted by the HQ to Rogožarski A.D on 18 March 1941 contained 22 improvements, some of which were recommended and implemented already on the first batch aircraft. Despite sourcing difficulties, both the HQ and Rogožarski A.D. agreed to commence second batch assembly at once. As a result, the second batch assembly started in January 1941 in parallel with the Hurricanes however until April only 15% of the required work was completed on IK-3s and 78% on the Hurricanes.

With the intent to get the Kingdom of Yugoslavia to join the Tripartite Pact, Germany applied considerable pressure and at the same time made some concessions. One of those concessions was the permission in December 1940 to allow the Kingdom to purchase 267 aircraft engines, amongst them were 35 Hispano Suiza 12Y-31 from war booty. That engine had 860 mhp power at 2,400 rpm at 3,250 m altitude and was to be coupled to the three bladed variable pitch made by Rogožarski.

With the order of the second batch, VV HQ accepted IK-3 as the third standard modern fighter type. This was an ad hoc decision, made due to lack of the ability to purchase alternative fighters. The import of captured French engines from Germany enabled the production to continue, but the factory had to, in advance and at own expense, organize the production of parts and assemblies which were realized slowly. Until 15 February 1941 none of the 35 “Avia HS 12Y-31” engines on order from the Protectorate of Bohemia and Moravia were delivered. There is no information confirming that some of the engines were delivered after the said date, however this is not likely.

Numerous VV aircraft were captured and lined up at Beograd Airport by the German occupation forces. IK-3 2152 (Br.3) is visible in the front of left row. (Tomasz Kopanski via Nenad Miklušev)





To validate the proposed changes on the second series aircraft, one of the aircraft from the first series, 2156/7, was modified with the modification funded by the Rogožarski A.D. factory. If the modifications proved to be successful, an option existed to modify the first batch aircraft as well to the new standard. By 6 April 1941, 97% of the required modifications were completed. As a result, the modified 2156/7 was delivered on 7 April, returned to the 161.E and was flown in combat by *nar* Milisav Semiz.

Aft view of 2162 (Br.13) showing the location of EvBr on the fuselage as well as a Yugoslav flag band (tail stripes) across the rudder and partially the vertical stabilizer. Note the second EvBr (№2162) applied afterwards on top of the vertical stabilizer. Amongst other captured aircraft are Caproni Ca.310, Zmaj-built Hurricane, Zmaj FP-2 and Ikarus-built Avia BH-33. (Jan van den Heuvel via Aleksandar Ognjević)

1941 April War

The capital's fighter regiment, 6.LP was tasked with the defense of Belgrade and large areas of northern Serbia, Banat, Bačka, Srem, east Slavonia and east Bosnia. The successful defense of such vast territories was not technically feasible, however in a short period of time prior to the war nothing could be done to improve this situation. The Commander of the 6.LP divided these territories accordingly between different groups and the 51.VG was strengthened with the 102.E armed with Me-109s. The 51.VG was focused on the defense of the capital city Belgrade with peripheral areas of Banat and northern Serbia as well.

| 51.VG structure on 6 April 1941 | |
|---|----------------------------------|
| 51.VG (2 Potez 63) <i>maj</i> Romeo Adum <i>kap</i> Ik Konstantin Antonov | |
| 161.E (3 IK-3) | 162.E (3 IK-3) |
| CO <i>kap</i> Ik Todor Gogić | CO <i>kap</i> Ik Sava Poljanec |
| <i>ppor</i> Dušan Borčić | <i>kap</i> Ik Bratavoje Urošević |
| <i>rez ppor</i> Miloš Gagić | <i>nar</i> Dobrivoje Milovanović |
| <i>nar</i> Milisav Semiz | <i>nar</i> Nikola Jović |
| <i>nar</i> Dušan Vujičić | <i>nvtč</i> IVk Eduard Banfić |

On 6 April 1941 VV could rely only on six Rogožarski IK-3s evenly split between the 51.VG 161.E and 162.E. The remaining five IK-3s were not in flying order, as two were at the Rogožarski factory workshop on scheduled service, one was undergoing modification to second series standard and two were under repair at the 6.LP workshop, mostly due to damaged landing gear and bent propellers, which occurred during landings. At Beograd Airport, 51.VG went on alert an hour before daylight. Pilots strapped in their cockpits in hangars to prevent destruction in the open, engines were warmed up. The *Luftwaffe* aircraft approached in Gruppe strength in 15-minute intervals and, as the first small dots appeared in the sky, all but one of the 51.VG 161.E and 162.E aircraft as well as those from 102.E scrambled at 6:50 in five-minute intervals from the grass airstrip at the Beograd Airport. Patrols took off in two parallel columns with *kap* Ik Sava Poljanec and *nar* Dušan Vujičić (aborted), *nar* Dobrivoje Milovanović and *nar* Milisav Semiz and finally *ppor* Dušan Borčić and *nvtč* IVk Eduard Banfić. IK-3 with

Another fine shot of the first series IK-3 2162 (Br.13) at Beograd Airport in April/May 1941 showing its distinct three tone camouflage scheme to good effect. This machine was flown by kap Ik Todor Gogić on 7 April when it landed damaged at Beograd Airport. It was finally scrapped in 1942. (Jan van den Heuvel via Nenad Miklušev)



nar Vujičić did not take off due to a flooded engine, a common problem with carbureted engines, so group had only five fighters in the air. As a result of his wingman's aborted take off, *kap* Ik Poljanec waited for the other pairs to take off and then followed suit.

The first German attack (06:45-08:00) against Belgrade was conducted by 160 twin engine bombers and 74 Stukas escorted by 92 Bf 109s and 27 Bf 110s.

IK-3s made first contact with the bombers, but within moments the Bf 109Es of JG 77 were upon them and a fierce dogfight commenced. Several claims were made by the defending IK-3 pilots, with one of the Yugoslav fighters from 161.E shot down, two more from 162.E badly damaged and subsequently destroyed or damaged in force-landings. One of the pilots, *ppor* Borčić of 161.E was killed, when his IK-3 2159/10 crashed in the swamp behind the Danube river embankment after being shot down by *Hptm.* Helmut Heinz of 4./JG 77 who erroneously claimed his 6th kill as a Hurricane at 7:15. Before being shot down *ppor* Borčić managed to shoot down a Do 17Z and a Bf 109. Two other pilots were wounded. *Nvtč* IVk Banfić of 162.E crash landed near the airport during his landing approach after sustaining damage following a dogfight with Bf 110s and was attacked and wounded by *Fw.* Erwin Riehl of 9./JG 77, who erroneously claimed this as his 1st kill mistaking the aircraft as a Dewoitine. The pilot was seriously injured having been shot in the leg and landed his IK-3 2158/9 on a plowed field near Surčinsko Polje. Commanding Officer of 162.E, *kap* Ik Poljanec while taking off at an altitude of 200 m and flying at low speed, was attacked by German Bf 109Es. He aborted take off and banked his aircraft sideways pretending he lost control. With irregular engine operation and White smoke from the evaporating glycol, he went in for landing. The trick succeeded, and German fighters left him alone however just before landing a German Bf 110 showed up and attacked him, with a cannon round hitting behind the pilot's seat. His canopy flew off and he was wounded to the left shoulder. He succeeded to land, he was treated on the spot and then sent to a hospital. He flew IK-3 2158/9 during this short flight. *Nar* Semiz and *nar* Milovanović returned to Beograd around 08:00 following an unsuccessful attack on the German bombers. *Nar* Semiz claimed a Ju-87B shot down, however one of the mechanics which was going to replenish the bullets in their aircraft discovered that none were expanded.

The second *Luftwaffe* attack between 10:30-11:00 by 57 Ju-87 and 61 fighters was met by a mix of five 51.VG fighters (two IK-3s from 161.E and three Me-109s from 102.E) and nine 32.VG fighters from Krušedol. IK-3s were piloted by *kap* Ik Todor Gogić flying the IK-3 2162/13 and *nar* Milisav Semiz again flying the 2160/11. Both Groups claimed one and three victories respectively. One Ju-87 was claimed by the new CO 51.VG *kap* Ik Gogić, since *maj* Romeo Adum had at once been removed by the Brigade Commander due to his defeatism during the first attack. Pilot *kap* Ik Gogić managed to return from all engagements without sustaining damage and landed at Veliki Radinci along with *nar* Semiz who accompanied him on this mission. Two more *Luftwaffe* attacks followed during the afternoon, one between 15:30-16:00 by 94 bombers (60 Ju-88s and 34 Ju-87s) from the airfields mostly around Vienna escorted by 40 fighters, and one between 16:00-17:30 by 99 Do-17Z bombers (including 17 from the attack at 22:30) and 30 fighters as escort during the daylight raid.

As 161.E and 162.E survivors returned to bases after exhausting all of their ammunition and fuel, the unit found it had only three IK-3s still airworthy and combat ready, all based overnight at Veliki Radinci. 161.E. and 162.E had one IK-3 each destroyed whereas the latter had one also heavily damaged.

They claimed in return some five *Luftwaffe* aircraft shot down and damaged. *Luftwaffe* losses were substantially lower. It is also possible that some of the bombers claimed by the VV pilots were actually twin engine Bf 110s, which were easily outmatched by the IK-3.

On 7 April, *Luftwaffe* tactics over Belgrade changed as there were no repeated mass attacks. Instead, throughout the morning and early afternoon small formations of three or four aircraft approached high above the clouds, dove through them, released bombs and retreated at once. At 10:00 *kap Ik Gogić* in 2162/13, *nar Semiz* and *nar Vujičić* returned from Veliki Radinci to Beograd. Following the return, IK-3s were sent up to intercept intruders, who upon seeing the Yugoslav fighters attempted to hide in the clouds. IK-3 pilots made up to eight scrambles during that day as a result, both in groups or individually. A pair of IK-3s with *kap Ik Gogić* and *nar Semiz* took off at 13:40 along with a pair Me-109s from 102.E on a pursuit of two Ju-88s from KG 51, which arrived over Belgrade from Romania in the early afternoon. One of the Me-109 pilots damaged a Ju-88A but was damaged in return and retreated to base which presented the opportunity for *kap Ik Gogić* to strike the final blow to the already crippled German bomber. *Kap Ik Gogić*'s IK-3 was damaged by return fire but managed to land back at Beograd. *Nar Semiz* claimed the second Ju-88 shot down, however could not see it fall as it was lost in the clouds.

Following the return to Belgrade, IK-3s were refueled and rearmed. At 15:30 *nar Vujičić* took off and claimed a Ju-88 from KG 51. A later at 17:00 on another sortie an IK-3 flown by *nar Semiz* was hit by return fire from three bombers. He landed having been hit 36 times, with 20 bullets lodged in the engine and the airscrew alone. Even with his IK-3 2160/11 spluttered with oil from the damaged engine, *Semiz* managed to land at Beograd Airport in one piece.

Early next morning, on 8 April, *Semiz* took charge of a factory fresh, modified and upgraded the second series prototype, IK-3 2163/7 (ex 2156/7 conversion), from Rogožarski A.D. and flew it over to the wartime Veliki Radinci auxiliary war airfield near Sremska Mitrovica, some 50 km north-west of Belgrade. The other two remaining IK-3s from Belgrade, piloted by *kap Ik Gogić* and *nar Vujičić*, flew over to Veliki Radinci as well and as a result, 51.VG again had three IK-3 fighters on strength.

The weather soon worsened and on 8, 9 and 10 April prevented any further air activity by the three surviving IK-3 fighters, so this time was used for necessary maintenance and repairs.

11 April was the ultimate day for IK-3 activities, when *nar Semiz* scrambled at 13:00, chased and allegedly shot down one Bf 110D while flying IK-3 2163/7 over Fruška Gora mountain near Novi Sad after German Messerschmitts attacked the airfield unsuccessfully. He returned to Veliki Radinci airfield successfully. The same day, Ju-87s protected by Bf 110s strafed Veliki Radinci airfield. A pair of IK-3s from 161.E flown by *kap Ik Gogić* in 2154/5 and *nar Vujičić* 2161/12 took off and supported by two Me-109s searched for enemy aircraft. The outcome of the sortie was that *kap Ik Gogić* shot down a Ju-87 and both pilots subsequently landed back at Veliki Radinci. The same evening, due to the enemy allegedly closing on their position, an order was issued to the ground crews to retreat towards Bijeljina airfield in Bosnia.

To prevent their capture at Veliki Radinci, at the dawn on 12 April, 6.LP ground crews burned 18 aircraft including seven Me-109s, three IK-3s, six Hurricanes an IK-2 and the sole captured Bf 110 (which following loss of orientation landed on 1 April by mistake at Kraljevo Airport), thus bringing an end to the short combat history of the IK-3. Soon, the jubilant invaders used the opportunity to pose for photographs with little that remained of the once determined and patriotic foe.

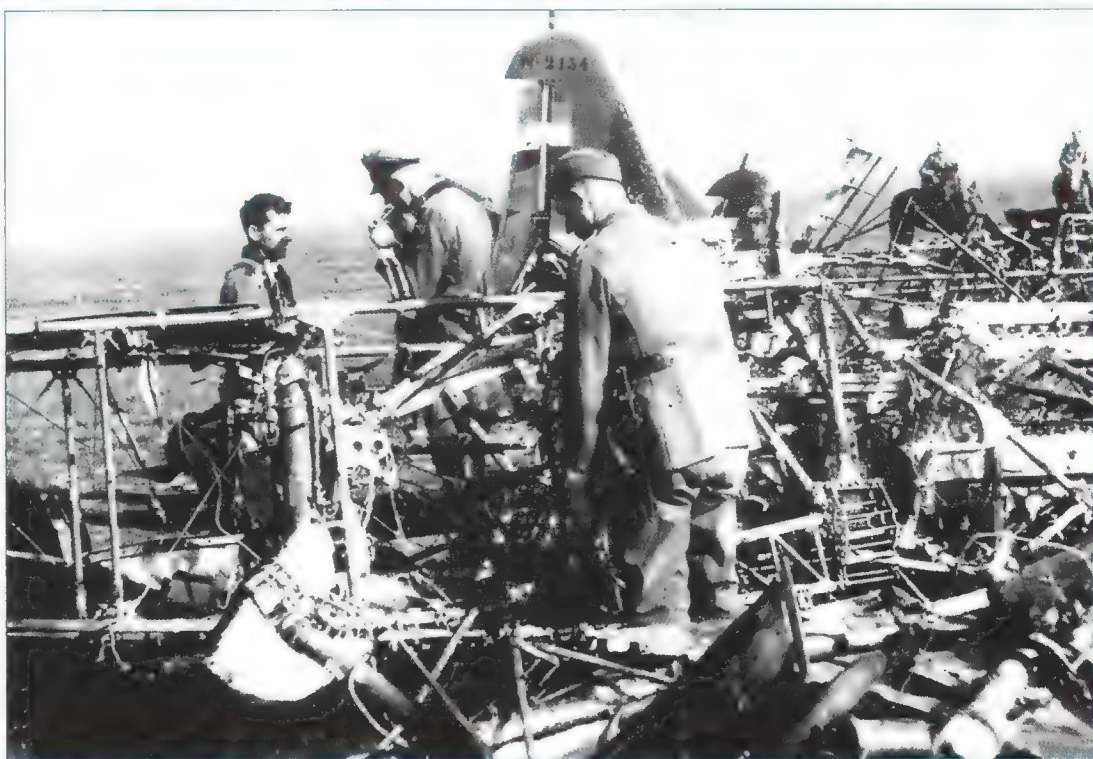


IK-3 2162 (Br.13) at Beograd Airport. It is interesting to note that the Chauvière propellers lack the double Yellow bands on the tips. Contrary to the practice at the time, the aircraft retained a large "Kosovo cross" underneath the port wing, slightly moved towards the fuselage. (Dénes Bernád)



The tails of IK-3 2161 (Br.12) and 2154 (Br.5) at Veliki Radinci on 12 April 1941 when Wehrmacht forces occupied the airfield area. (Jan van den Heuvel via Aleksandar Ognjević)

Another shot of tail of 2154 at the same place and at the same time. Note the fuselage structure of 2161 in the foreground and tail of 2163 (modified Br.7 ex-2156) in the background, the third of trio of IK-3 which were torched by 51.VG's personnel. (Djordje Nikolić)



When the German air units initially arrived at Beograd Airport, they did not pay much attention to what was found there as their presence was needed elsewhere and the stop at Beograd was only temporary. Some time later, likely in May, all captured aircraft were neatly lined awaiting disposition. Three IK-3s, 2162/13, 2160/11 and 2152/3 were captured at Beograd Airport and placed in this line up. The aircraft, which were designated for repair and those for scrapping were separated by a barb wire. The local workers, risking their lives, but with determination to prevent any of the serviceable aircraft from continuing service with the enemy, deliberately moved the barb wire to include the two IK-3s. A third and allegedly brand new IK-3, according to the account of one of the mechanics, Ivan Masnec, was in the corner of a hangar floor with its landing gear retracted.

At the time of the German attack, the second series of 25 IK-3 was in the early stages of production. This series was intended for delivery by the end of 1941. Additionally, two IK-3s, 2151/2 and 2153/4, were at Rogožarski A.D. factory workshops at Bežanijska Kosa near airport, undergoing repairs to the landing gear and propellers. These were most likely damaged beyond repair to prevent capture. It is widely assumed that at least one IK-3, most likely the third, unknown one from Beograd Airport, was been transferred to Germany by train, together with Ikarus Orkan heavy fighter and Bešlin-designed Ikarus B-5 experimental twin-engine aircraft with pilot in prone position. According to some accounts Orkan and B-5 were loaded on train carriages along with a third, canvas covered, aircraft which could have been the IK-3. Even though rumors existed for quite some time that the captured IK-3 ended up at the famous German test center at Rechlin, this has proven not to be the case.



Wehrmacht forces at Veliki Radinici: (top) German soldiers curiously look at the remains of IK-3 (Aviation Museum – Belgrade via Nenad Miklušev); German officers proudly posing on the remains of 2163, the second series prototype. (Djordje Nikolić)

Post war development

Rogožarski IK-3 was the only domestic fighter aircraft whose development continued after World War II. The design calculations, plans and factory drawings, which Slobodan Zrnić hid in the attic of his house during the entire war, were used to speed up the development of a new domestic fighter. Engineers Kosta Sivčev and Svetozar Popović joined the design team at Ikarus plant. Lead engineer, Ljubomir Ilić, left the design team and the country in 1947 due to disagreements with the political regime in Yugoslavia as well as personal treatment. Mention of his name as the lead designer of S-49 was strictly forbidden, however his colleagues secretly sent him some of his royalty payments. Even the original name IK-3 II has changed from the same reason into S-49.

New factory drawings were created in only three months and the first flight of the new aircraft, a Klimov VK-105PF-2 powered Ikarus S-49A, took place on 15 June 1949 with pilot Stanko Forkapič at the controls. In total 46 S-49A were produced, with sole surviving aircraft, Br.2319 (s/n 0309118), now residing at Belgrade Aviation Museum depot.

Even as the S-49A was entering service, the design team started working in an improved, superior performance version of the fighter. The first prototype S-49C Br.2351, powered by Hispano-Suiza 12Z engine, made its first flight on 23 August 1952 with pilot Vladimir Vodopivec at the controls. A total of 112 S-49Cs were produced, and these served at various fighter units in the country. The sole survivor, Br.2400, is preserved and displayed at the permanent exhibit at the Belgrade Aviation Museum.

Camouflage and Markings

Designations

The number 3 in the aircraft designation indicates the 3rd aircraft constructed by Ilić and Sivčev. Some prior allegations that the number 3 represents a Cyrillic letter З (Z), and that it was added when Slobodan Zrnić joined the team, are not true.

Designation in Cyrillic ИК-3 (IK-3) was often written differently such as I.K.-3, I.K.3 or even IKA-3. The aircraft's jargon nickname was "Ika". Prototype was generally known as ИК-3 *прототип* (IK-3 prototype), while newspaper often presented this machine as *Илић-Сивчев И.К.3* (Ilitch-Sivtchev I.K.3).

Serial numbers

The construction number was written on both sides of the rudder, first as Br.1 through Br.7, on the prototype and the first six overall Grey-Green aircraft. After the introduction of camouflage painting, all aircraft received construction number digits, 2 through 13. EvBr were painted on camouflaged IK-3s only, first on the side of the fuselage with small Black four-digit numbers, 2151 to 2163. After the EvBr re-organization in the late 1940, these numbers were painted on top of the vertical stabilizer.

Camouflage schemes

When Rogožarski IK-3 prototype was completed it was the only type to wear the proposed overall Light Grey Green fighter scheme with the state flag (Blue, White, Red) painted on the rudder. The Light Grey Green colour was sourced from France and had a semi-gloss finish.

All 12 IK-3 machines (Br.2 to Br.13) were originally factory painted in overall Rogožarski Grey Green colour, "the same as the prototype" as written in documents. Later, these aircraft gradually received three-tone camouflage scheme on the top surfaces, while the under surfaces remained the same Grey Green colour. In accordance with the official rule POV.VB.Br. 17804 from 18 December 1939, VV aircraft were to be painted in *svetlo siva* (Light Grey) the undersides and a new three colour camouflage scheme on the top surfaces: Dark Green, Dark Brown and Ochre Yellow. The Light Grey colour was a general term referring to colours such as Light Blue Grey, Light Grey Green and Rogožarski Grey Green and depended on paint manufacturers.

Some standardization was attempted as IK-3, Hawker Hurricane Mk.I and even Ikarus IK-2 wore similar camouflage pattern. This new camouflage scheme was applied on IK-3s between the May and October 1940. A three-colour paint pattern was sprayed with fine, soft edges between paint shades.

Camouflaged paints were sourced in Belgrade, from the Yugoslav branch of the Austrian paint manufacturer *Reichhold, Flügger & Böcking*, specifically their Durlin range of synthetic paints. They were mixed from the basic shades directly at the Rogožarski A.D. factory paint shop, using colour charts supplied by VV HQ. These paints were sprayed on and had a semi-gloss finish. The total weight of paints applied on aircraft was 25 kilograms!

Markings and inscriptions

The first prototype was delivered with 100 cm diameter "Kosovo cross" insignia placed in four positions on the wings. Small Black inscriptions, like *Rogožarski A.D. Beograd*, the factory logo, aircraft type and the engine data as well as c/n were painted on the vertical stabilizer. The first batch of six aircraft (Br.2 though Br.7) had the same markings.

After the introduction of the new rule POV.VB.Br. 1191 from 26 January 1940, the "Kosovo cross" insignia size on top of the wing was reduced to 70 cm diameter. The insignia were placed asymmetrically, retaining one large 100 cm "Kosovo cross" on the underside of the right and one small 70 cm on the upper side of the left wing. This rule was not followed on 2162/13 which had a large insignia below the left wing. The new rule was followed with regards to the rudder markings. Instead of the large state flag across the entire rudder, a small state flag (tail stripes) was applied across the vertical stabilizer and part of the rudder. A small inscription in Black later identifying the *Rogožarski AD Beograd* factory was applied on both sides of the vertical stabilizers and a White, stylized Rogožarski A.D logo was painted

Burned out IK-3 2154 (Br.5). Note the remains of two 7.92 mm FN machine guns, fuselage framework and survived vertical tail covering. (Jan van den Heuvel via Aleksandar Ognjević)



on top of the vertical stabilizer, below the EvBr location from the late 1940s. The sole service inscription on the IK-3 was a small Black ДИЖИ ОБДЕ (LIFT HERE) stencil placed on the rear fuselage, just above of the protruding through hole for the IK-3 rear fuselage lifting point, which was used for servicing. All inscriptions were written in Cyrillic letters, except for some on the prototype's rudder, which described the engine type used on the aircraft. HS 12Y-29 was applied on the port rudder side only.

All inscriptions on Rogožarski-built aircraft produced after 1934 were standardized and written in a special font (Cyrillic or Latin) with letters at an angle of 75 degrees. The font was taken from German DIN standard, and it was introduced by engineer Sima Milutinović, Technical Director and Chief Designer at Rogožarski, who finished studies in Germany.

| IK-3 | | Br. (c/n) | Original EvBr until autumn 1940 | New EvBr from autumn 1940 |
|-----------|-------------------------------|-------------------------------|---------------------------------------|---------------------------------|
| P 1 | | Br.1 | 2151 | - |
| I batch | 1 st half-batch | Br.2 | 2152 | 2151 |
| | | Br.3 | 2153 | 2152 |
| | | Br.4 | 2154 | 2153 |
| | | Br.5 | 2155 | 2154 |
| | | Br.6 | 2156 | 2155 |
| | | Br.7 | 2157 | 2156 |
| | | 2 nd half-batch | Br.8 | 2158 |
| | Br.9 | | 2159 | 2158 |
| | Br.10 | | 2160 | 2159 |
| | Br.11 | | 2161 | 2160 |
| | Br.12 | | 2162 | 2161 |
| | Br.13 | | 2163 | 2162 |
| | P2 | | Br.7 | - |
| II batch* | | Br.14-38 | - | 2164-2188 |

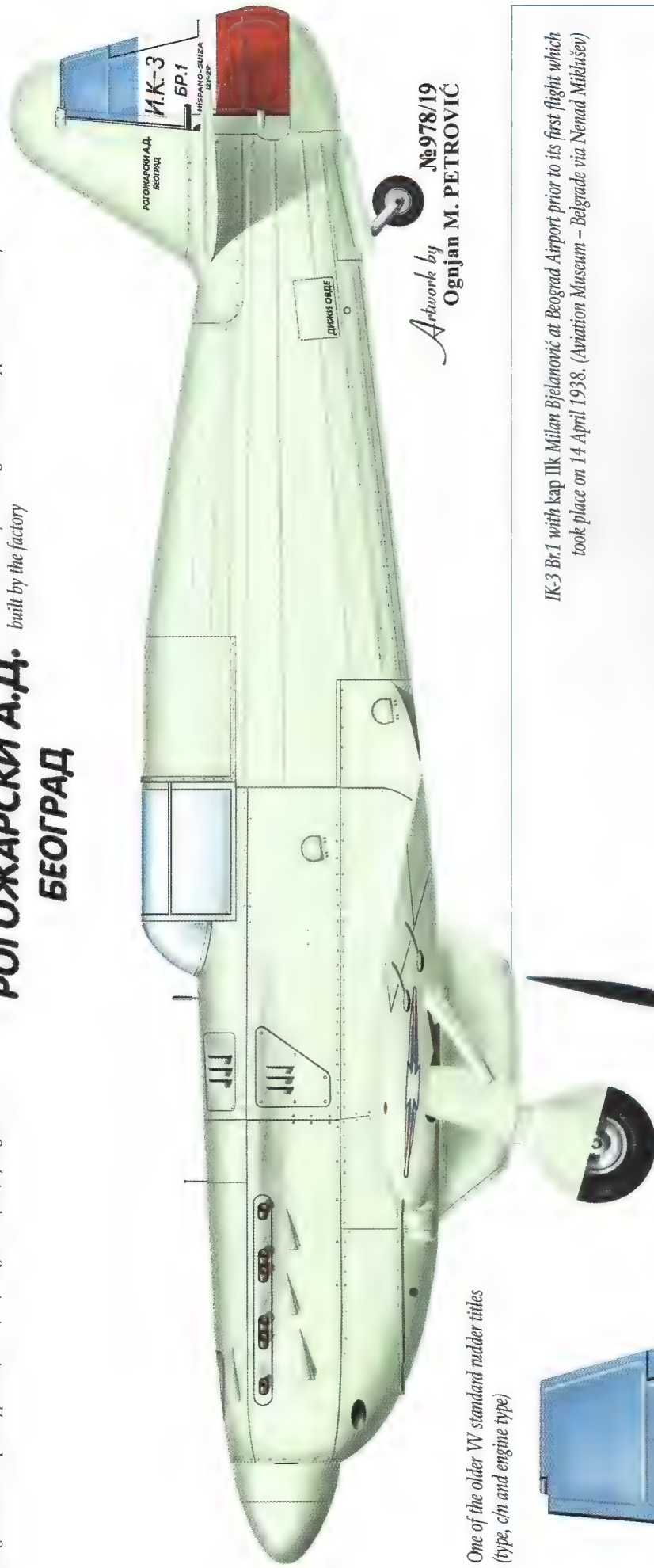
* 25 ordered IK-3 II, undelivered

| Rogožarski IK-3 individual aircraft history | | | | |
|---|-----------|--------------------------|-----------------------------------|---|
| Br. (c/n) | EvBr | Delivery | Pilot on last flight | Fate |
| 1 | - | 14 April 1938 | <i>kap Ik</i> Milan Pokorni † | Crashed on 19 January 1938 killing the pilot. |
| 2 | 2151 | 15 December 1939 | N/A | Captured at Rogožarski A.D. factory Beograd Airport assembly line and repair shop. Likely candidate for Daimler Benz DB.601 installation. Destroyed by factory workers. |
| 3 | 2152 | 26 April 1940 | <i>kap IIk</i> Bratovoje Urošević | Crash landed 5 April 1941. Captured at Beograd Airport. Scrapped April 1942. |
| 4 | 2153 | 26 April 1940 | N/A | Captured at Rogožarski A.D. Zemun assembly line and repair shop. Likely destroyed by factory workers. |
| 5 | 2154 | 26 April 1940 | <i>kap Ik</i> Todor Gogić | Destroyed 12 April 1941 at Veliki Radinci airfield by own crew. |
| 6 | 2155 | 26 April 1940 | <i>kap Ik</i> Anton Ercigij † | Crash on 3 September 1940. Pilot KIA. |
| 7 | 2156 | 26 April 1940 | <i>nar</i> Milisav Semiz | c/n 7/2156 modified to II prototype 2163, delivered to Veliki Radinci on 8 April 1941. |
| 8 | 2157 | 8 July 1940 | <i>kap Ik</i> Sava Poljanec | Damaged at Beograd Airport on 6 April 1941 on takeoff. Captured. Scrapped 1942. |
| 9 | 2158 | 8 July 1940 | <i>nvtč IVk</i> Eduard Banfić | Belly landed at Surčinsko Polje following a dogfight on 6 April 1941. Later dismantled and transported to Beograd Airport. Scrapped 1942. |
| 10 | 2159 | 8 July 1940 | <i>ppor</i> Dušan Borčić † | Shot down on 6 April 1941 over Belgrade. |
| 11 | 2160 | 8 July 1940 | <i>nar</i> Milisav Semiz | Landed damaged on 7 April 1941 at Beograd Airport. Captured. Scrapped 1942. |
| 12 | 2161 | 8 July 1940 | <i>nar</i> Dušan Vujičić | Failed take off attempt on 6 April 1941 due to flooded engine. Repaired on 7 April. Destroyed 12 April 1941 at Veliki Radinci airfield by own crew. |
| 13 | 2162 | 8 July 1940 | <i>kap Ik</i> Todor Gogić | Landed damaged on 7 April 1941 at Beograd Airport. Scrapped 1942. |
| 7 | 2163 | 7 April 1941 | <i>nar</i> Milisav Semiz | Conversion of c/n 7 ex 2156. Destroyed 12 April 1941 at Veliki Radinci airfield by own crew. |
| 14-38 | 2164-2188 | Scheduled time late 1941 | - | 25 second batch aircraft IK-3 II with assigned s/nos – incomplete in April 1941. |

Note: Pilot names assigned to some aircraft cannot be determined with absolute certainty because aircraft were shared by several pilots and were flown intensively with numerous flights each day.

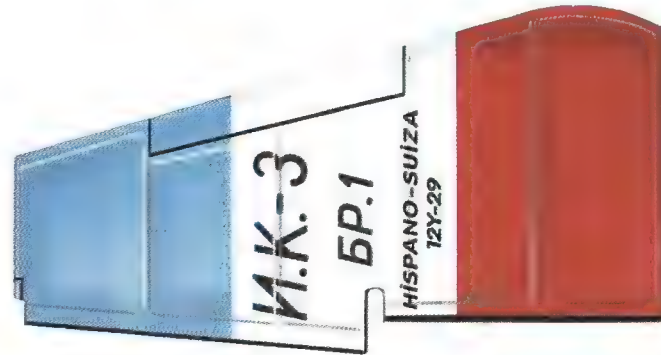
РОГОЖАРСКИ А.Д. БЕОГРАД

Standardized Cyrillic Rogožarski title applied on all aircraft built by the factory



Artwork by
Ognjan M. PETROVIĆ
№978/19

One of the older VV standard rudder titles
(type, chn and engine type)



IK-3 Br.1 with kap Ilk Milan Bjelanović at Beograd Airport prior to its first flight which took place on 14 April 1938. (Aviation Museum – Belgrade via Nenad Miklušev)

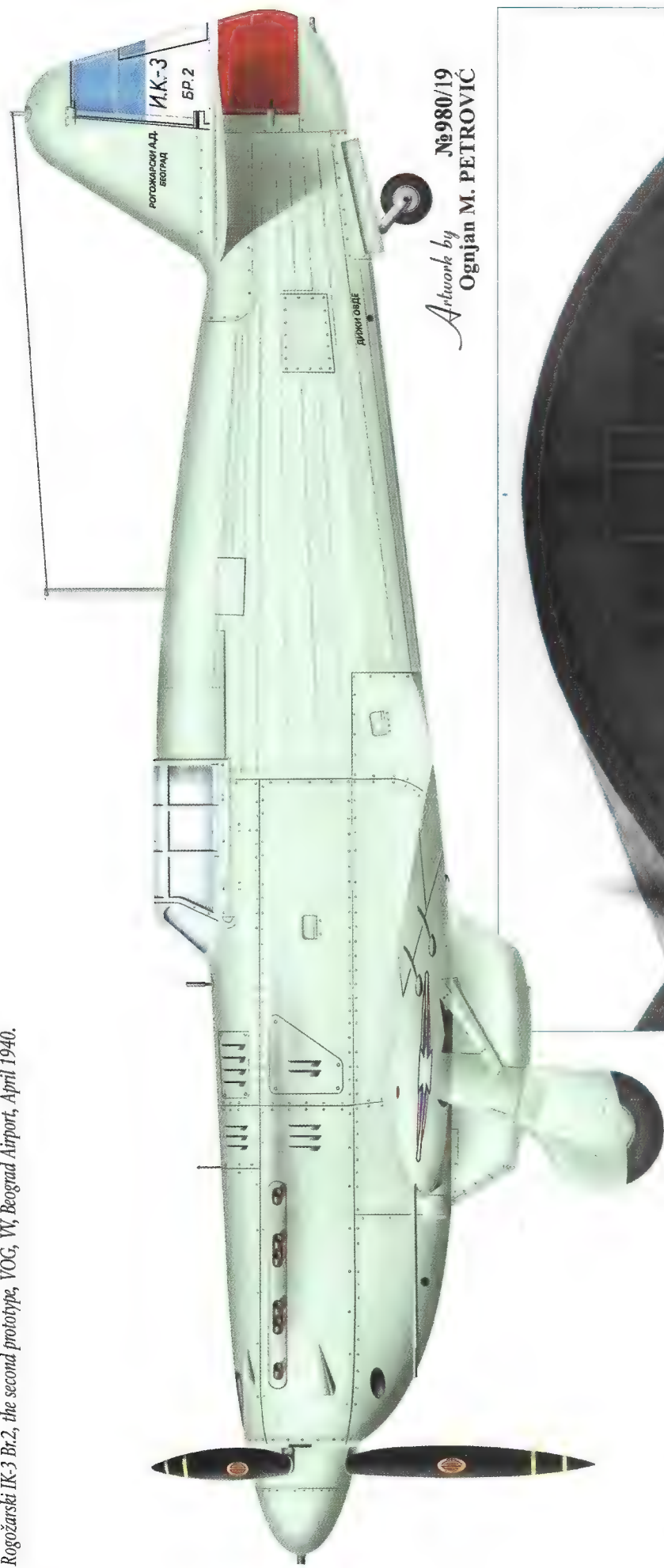


Upper and under views of IK-3 prototype Br.1 (№1).



Logos of Rogožarski A.D. and Hispano Suiza.

This machine had overall French origin Light Green scheme. Standard peace-time 100 cm diameter "Kosovo crosses" were applied in four wing positions.



И.К.-3 БР.2

Rudder titles.

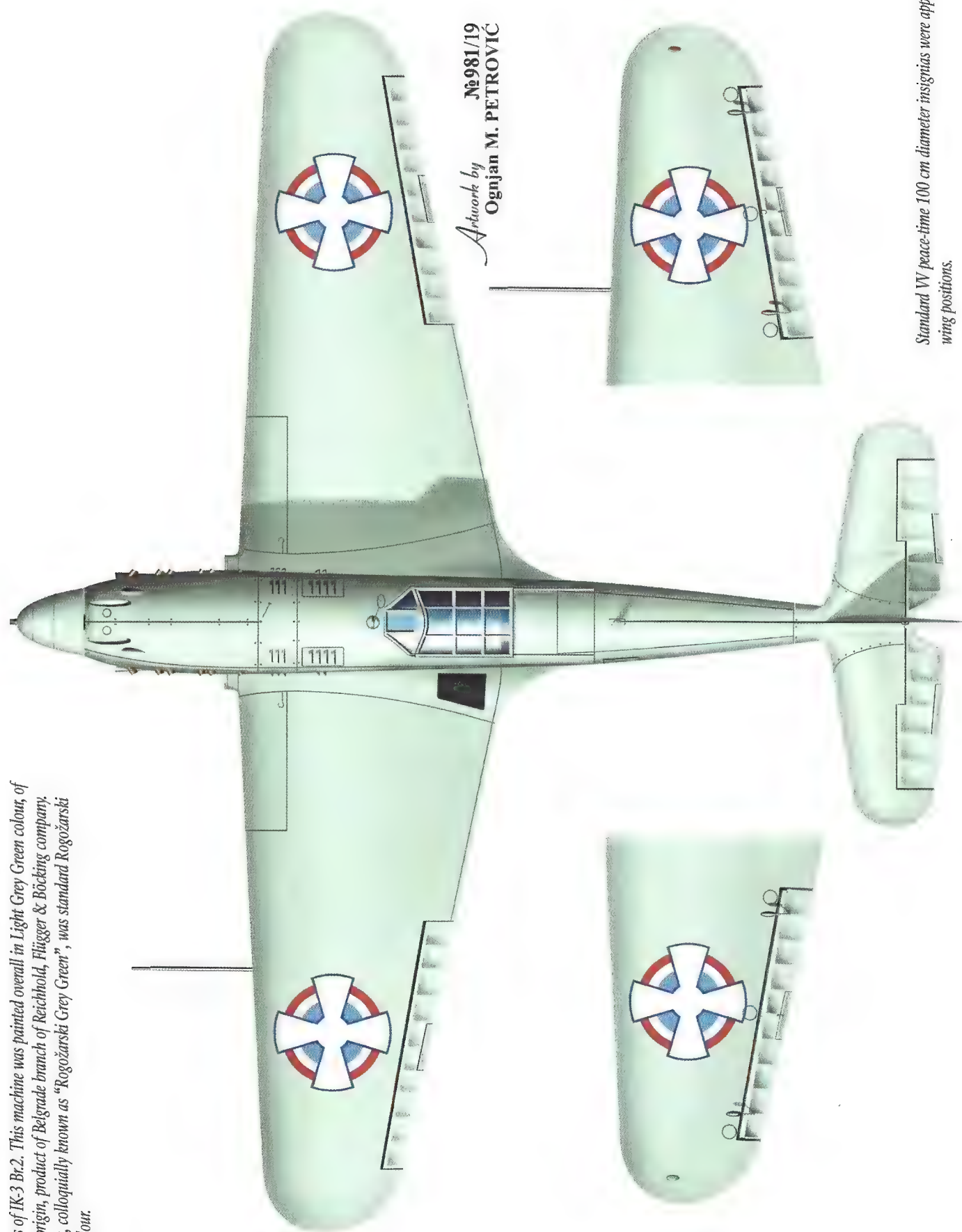
ДИЖИ ОВДЕ

Service title (lift here).



IK-3 Br.2 with its engine running on 27 April 1940 prior to a test flight. Note the absence of antenna wire. (Malcolm Passingham via Nenad Miklušev)

Plan views of IK-3 Br.2. This machine was painted overall in Light Grey Green colour, of domestic origin, product of Belgrade branch of Reichhold, Flügler & Böcking company. This paint, colloquially known as "Rogožarski Grey Green", was standard Rogožarski factory colour.



Standard WW peace-time 100 cm diameter insignias were applied in four wing positions.

Small-sized rudder stripes appeared on IK-3 fighters in parallel with three-tone camouflage scheme. Note EvBr on fuselage side (2153) and construction number (4), original Rogožarski logo and title on vertical stabilizer.

2153 4 **РОГОЖАРСКИ А.Д.**
БЕОГРАД

ДИЖИ ОВДЕ

Rogožarski IK-3 2153 c/n 4, 51.VG, 6.LP, Beograd Airport, autumn 1940.

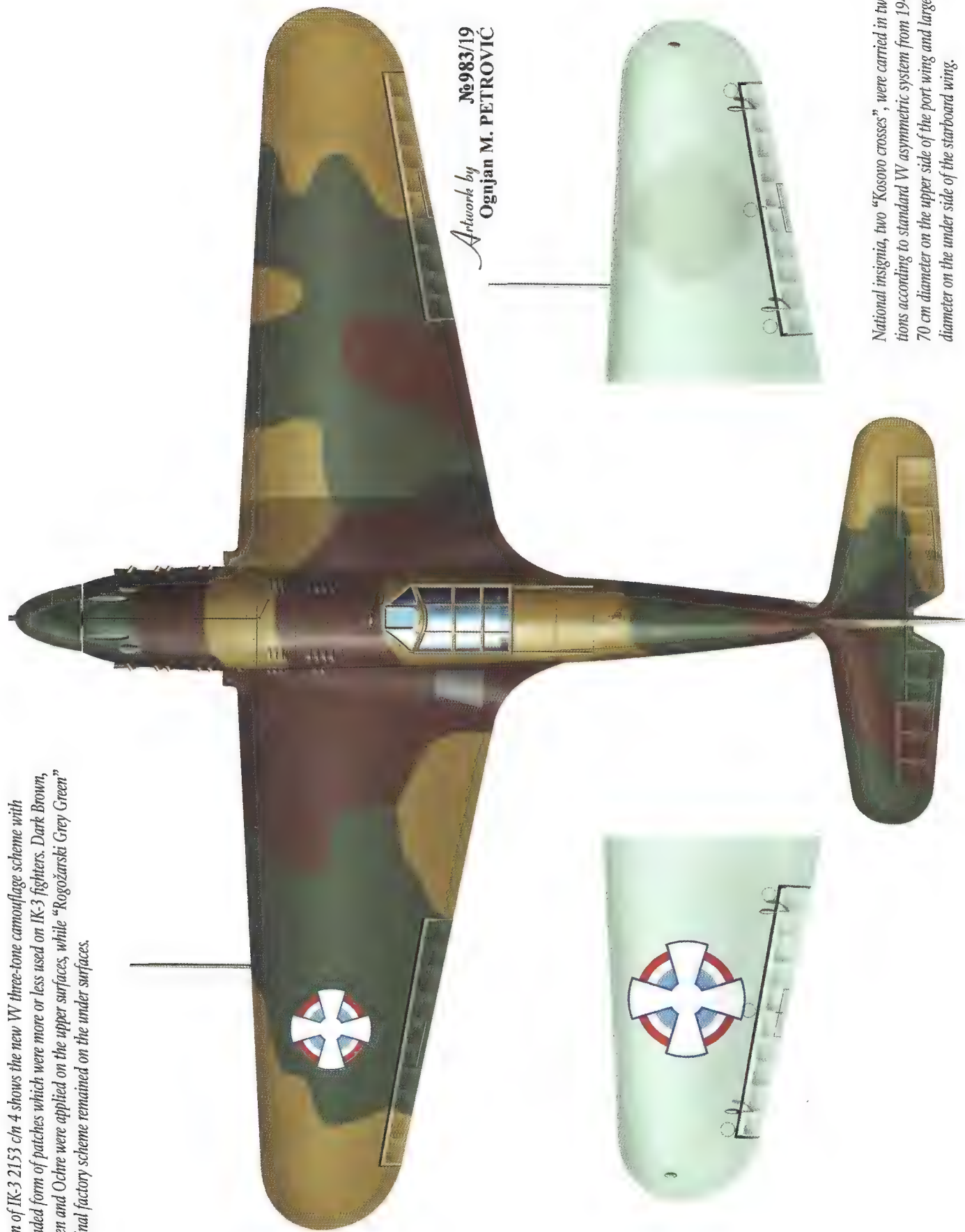


Artwork by
№982/19
Ognjan M. PETROVIĆ



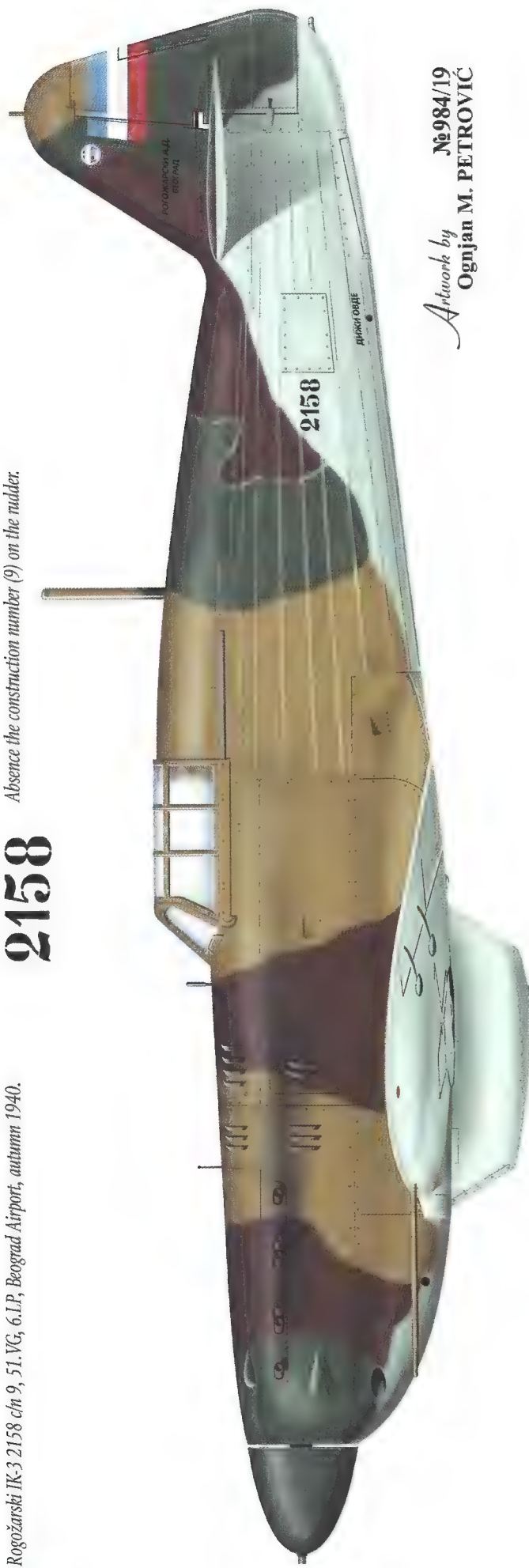
51.VG 6.LP pilots in front of IK-3 Br.4 in June 1940 at Beograd Airport, when the machine still carried the original EvBr 2154. Another IK-3 with engine panels off is visible in the background. Standing from the left to right are: rez kap Ik Aleksandar "Aca" Stanojević, kap Ik Anton "Tonči" Erčigoj, kap Ik Miloš "Miša" Bajagić, kap Ik Ilija "Ika" Zelenika, kap Ik Todor "Toša" Gogić, maj Stevan "Steva" Ivanić, kap Ik Miodrag "Brega" Blagojević, kap Ik Sava Poljanec, por Dušan "Borac" Borčić, kap Ik Branivoje "Bran" Petrović, and private Ljubomir "Vojin" Miličević (the man who saved this photograph and presented it to the Aviation Museum). Kneeling from left are: Edvard "Edo" Banfić, Vasilije "Vasa" Vračević and Pantelija "Panta" Grandić, all nvtč IVk. Only six IK-3s were serviceable at the time of the German attack on 6 April 1941. (Aviation Museum – Belgrade via Nenad Mikušev)

Upper plan of IK-3 2153 c/n 4 shows the new VV three-tone camouflage scheme with recommended form of patches which were more or less used on IK-3 fighters. Dark Brown, Dark Green and Ochre were applied on the upper surfaces, while "Rogożarski Grey Green" from original factory scheme remained on the under surfaces.



National insignia, two "Kosovo crosses", were carried in two wing positions according to standard VV asymmetric system from 1940: smaller, 70 cm diameter on the upper side of the port wing and larger, 100 cm diameter on the under side of the starboard wing.

2158

Absence the construction number (9) on the rudder.

Artwork by №984/19
Ognjan M. PETROVIĆ



The second series IK-3 2158 (Br.9) showing the camouflage pattern applied at the factory by 1940. Note the different demarcation line between lower and upper colours compared to the other machines and a thin line between Dark Green and Dark Brown patches on the fuselage above the serial number which remained uncovered during repainting. (Aviation Museum – Belgrade – via Nenad Mikišev)

Rogožarski IK-3 2162 c/n 13, 51.VG, 6.VP, VV, April 1941.

№ 2162 13 2162

Newly applied EnBr (№2162) on the rudder, c/n (13) and original EnBr (2162).



Artwork by
Ognjan M. PETROVIĆ



Captured IK-3 2162 (Br.13) at Beograd Airport, late spring 1941. Note the missing panels and tail wheel. In the background on the left is Potez 63 2071 and on the right is freshly overhauled Caproni Ca-310. (Jan van den Heuvel via Aleksandar Ognjenović)

| Aircraft Characteristics Rogožarski IK-3 first prototype | |
|--|---|
| Quantity used: | 1 |
| Crew: | 1 |
| Years of Service: | 1938-1939 |
| Span: | 10.3 m (33.8 ft) |
| Length: | 7.9 m (25.8 ft) |
| Height: | 3.6 m (11.7 ft) |
| Wing area: | 16.5 m ² (178 ft ²) |
| Engine: | One 920 mhp (907 hp) Hispano Suiza 12Y-29 |
| Empty weight: | 2,077 kg (2,374 lb) |
| Loaded weight: | 2,518 kg (5,551 lb) |
| Maximum speed: | 524 km/h (326 mph) at 5,450 m (17,881 ft) |
| Service ceiling: | 10,500 m (34,448 ft) |
| Climb to 5,000 m: | 7 min 0 s |
| Range | 785 km (488 ml) |
| Endurance: | 1 h 58 min at cruising speed, 1 h 30 min at full throttle |
| Armament: | Two synchronized 7.7 mm M.30 (Darne 1930) machine guns |

| Aircraft Characteristics Rogožarski IK-3 first batch* | |
|---|--|
| Quantity used: | 12 |
| Crew: | 1 |
| Years of Service: | 1939-1941 |
| Span: | 10.3 m (33.8 ft) |
| Length: | 8.1 m (26.6 ft) |
| Height: | 3.5 m (11.5 ft) |
| Wing area: | 16.5 m ² (178 ft ²) |
| Engine:** | 920 mhp (907 hp) Hispano Suiza 12Y-29 |
| Empty weight: | 2,170 kg (4,785 lb) |
| Loaded weight: | 2,664 kg (5,874 lb) |
| Maximum speed: | 520 km/h (323 mph) at altitude of 4,550 m (14,939 ft) |
| Service ceiling: | 9,400 m (30,840 ft) |
| Climb to 6,000 m: | 10 min |
| Range | 545 km (339 ml) |
| Endurance: | 1 h 18 min |
| Armament: | One hub-firing 20 mm M.39 E.M. (Oerlikon FFS/MK) cannon and two synchronized 7.92 mm M.38 (FN Browning) machine guns |

* According to VOG test results of IK-3 Br.2.

** The documents and literature state the Czechoslovak (Avia) and French (Hispano-Suiza) origins of the IK-3 engine. The authors believe that these engines are originally French, although their factory numbers continue in the next block of 5-digit numbers after the engines installed on the older IK-2 type.

| Aircraft Characteristics* Rogožarski IK-3 II prototype | |
|--|---|
| Quantity used: | 1 conversion |
| Crew: | 1 |
| Years of Service: | 1941 |
| Maximum speed: | 530-540 km/h (330-336 mph) at 5,000 m (16,405 ft) |

* Other characteristic are identical to these of IK-3 first batch

| Aircraft Characteristics* Rogožarski IK-3 second batch | |
|--|--|
| Quantity ordered: | 25 |
| Crew: | 1 |
| Years of Service: | Anticipated entry into service in September 1941 |
| Engine: | One 860 mhp (848 hp) Hispano-Suiza 12Y-31 or 12Y-29 |
| Empty weight: | 2,170 kg (4,785 lb) |
| Loaded weight: | 2,666 kg (5,877 lb) |
| Maximum speed: | 520 km/h at height of utilization, 438 km/h at sea level |
| Climb to 5,000 m: | 7 min 49 s |
| Endurance: | 1 h 18 min at full throttle |

* According to Specifications requested by VV HQ in Pov. V.T. Br. 970 from 18 March 1941 sent to Rogožarski factory. Permitted deviation of 3% for weights and 5% for speed. Other characteristic as for IK-3 first batch.

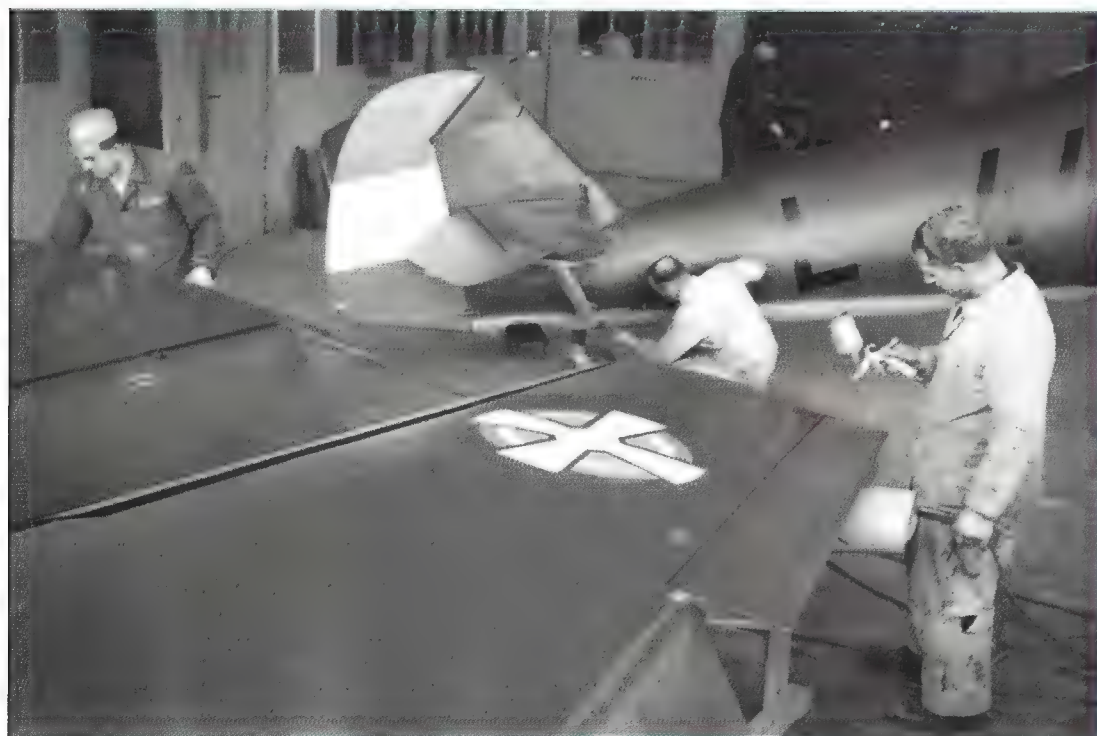
Messerschmitt Bf 109E-3a

(VV Me-109)

Background

The most numerous and most famous single seat World War II fighter was without a doubt the Messerschmitt Bf 109, manufactured by Bayerische Flugzeug Werke (BFW), later Messerschmitt A.G. Better known as the “Eagle from Augsburg”, it was designed by engineer Robert Lusser who pioneered the design manufactured in accordance with the latest available technologies and modern aerodynamics theories. Together with the British Hawker Hurricane and Supermarine Spitfire, it spurred the new era of low wing fighter aircraft. Bf 109 utilized a number of design concepts first trialed on its predecessor, the Bf 108, which sped up the development and ensured the successful series production until the end of World War II in about 100 different versions. The first prototype Bf 109V-1 (*Versuch* – trial) D-IAB1 (W.Nr.758) took off on 28 May 1935. Shortly thereafter further prototypes, V-2 through V-13, were manufactured and used for the development of series production versions. The first small series of 16 fighters were Bf 109A, then 337 Bf 109B-1 and B-2 from 1937 and were soon followed by 60 C-1, C-2 and 653 D-1 versions.

In the summer of 1938 the famous Bf 109E (called Emil from letter E in German telephone communication also adopted by the *Luftwaffe*), whose prototype was V-14 D-ISLU (W.Nr. 1929), took flight. Yugoslav Engineer Kosta Sivčev went to Germany and on 18 October 1938 during an official visit to the Erla Maschinenwerk GmbH factory near Leipzig he inspected the first Bf 109E series production. The first series Bf 109E-1 with the Daimler Benz DB.601A engine was introduced in *Luftwaffe* service in February 1939. Already in September of the same year it became the standard German fighter aircraft, evolving into the fighter bomber E-1/B. During 1939 series production of the improved Bf 109E-3 with



Brand new VV Me-109 during painting at Bayerische Flugzeug Werke Regensburg. In the foreground the “Kosovo cross” insignia is clearly visible, while the aircraft in the background is L-44. (Österreichische Nationalbibliothek Vienna)

Delivery of Me-109 L-37, Regensburg, Third Reich, winter 1939/1940: (top) with disassembled wings this aircraft is towed in the snow towards the railway station; (bottom) Once at the railway station, L-37 was carefully loaded into the rail wagon. 52 Me-109 fighters were transported by rail to the Kingdom. (both Österreichische Nationalbibliothek Vienna)



the DB.601Ae engine began and in 1940 a production capacity of 150 aircraft per month was achieved. The E-3 was the first series version which brought fame to Messerschmitt. This version formed the core of the *Luftwaffe* fighter strength during the Battle of Britain in the summer of 1940. After this version, Bf 109E-4, E-1/N, E-5, E-7 and E-9 were developed. In total, 3,700 E-series fighters were manufactured of which 1,445 were E-3 version (48 at Augsburg, 284 at Regensburg, 838 at Erla and 275 at WNF).

The pattern aircraft for the export version, Bf 109E-3a (*ausländisch* – foreign) was the prototype Bf 109V-19 D-IRTT (W.Nr.1797). The first flight took place on 26 October 1938 with test pilot Fritz Wendel at the controls. Germany planned to export a total of 308 Bf 109E-3a: 19 to Bulgaria, two to Japan, 100 to the KJ (realized 73), 69 to Romania, three to USSR, 80 to Switzerland and 41 to Spain. In 1942 Slovakia also purchased 25 Emils.

In Yugoslav service

At the beginning on 1939, the negotiations took place between KJ and *Dritte Reich* (Third Reich as Germany was officially called) concerning the acquisition of modern weapons. The Yugoslavs accepted an offer for a credit for this purchase however, this was conditioned by the request to change the Yugoslav foreign policy. The KJ as a result, urgently attempted to find alternate source for modern equipment by approaching Great Britain and France which was successful, since in June the delivery of Bristol Blenheim Mk.I (VV designation B-1) bombers was agreed upon. Seeing that the KJ was approaching its prospective enemies, Germans finally accepted to grant credit for the procurement of the requested weapons with the condition that concessions for the exploitation of oil be permitted. A secret protocol was signed on 5 July 1939 which planned for the delivery of 100 Dornier Do-215s, 100 Messerschmitt Bf 109s, 34 Fieseler Fi 156s, 72 Henschel Hs 126s and 200 training Bücker and Klemm aircraft. The value of this protocol was a total of 75 Million Reichmarks. A new secret German-Yugoslav protocol (*Deutsch-Jugoslawische Geheimprotokoll*) followed on 5 October 1939 which worked against the Yugoslav interests and contained only the delivery of 100 Bf 109E-3a fighters and 13 Bf 108B trainers as well as Škoda artillery and anti-aircraft weapons. As the outcome of this protocol, the Yugoslav government signed with Messerschmitt A.G. concern on 23 October 1939 in Belgrade a contract to deliver 100 Bf 109E-3a fighters including the spare parts. At the same time *arm den* Milojko V. Janković (VV Commander 1939-1940) requested to the German authorities, who were present at the time, the delivery of another 100 Messerschmitt fighters. In December of the same year a follow-on contract was signed for the delivery of 50 spare Daimler Benz DB.601Aa engines.



The Yugoslav pilots who were part of the *Комисија BB за пријем материјала у Немачкој* (VV equipment acceptance commission in Germany) flew training flights in Bf 109E while in Germany from mid January to mid March 1939. From mid July acceptance flights were undertaken with aircraft which carried Yugoslav markings. Following the Yugoslav request on 22 February, Messerschmitt A.G. made an offer for the delivery of the first batch of 50 Bf 109E-3a. The request for the second batch of 50 fighters was submitted already on 6 July of the same year.

The first five Bf 109E-3a machines (designated by VV simply as Me-109), arrived on 14 August 1939 at Beograd even before the contract was signed. One fighter (coded L-5) was damaged during landing and was later repaired. In accordance with the delivery schedule, the next 23 fighters were due to arrive in October and further 15 in December. By the end of 1939 Germans have shipped a total of 40 Me-109s however, only 39 arrived since one (unknown code) was destroyed during a ferry flight on 1 November 1939 killing a German ferry pilot. At the end of March and the beginning of April 1940, Germany sent its largest shipment of weapons to the KJ, including no less than 33 Me-109s. Again, during the ferry flight on 15 March, Me-109 L-55 (coded D-IWKU) crashed and was destroyed. From the contracted 100 aircraft, and shipped 76 aircraft, only 73 arrived and 27 were never delivered. According to German documents, the deliveries of the last 27 aircraft were intended for May (10), June (10) and July (7). The last aircraft which were intended for the delivery were most likely going to be from used *Luftwaffe* stocks since the production of the E version at the time was stopped in favor of the more advanced F version.

The rest of the aircraft intended for KJ were instead taken over by the *Luftwaffe*. Similarly, the delivery of weapons for the Me-109 was delayed. Instead of the contracted delivery date for the machine guns of March to April 1940, these were received finally at the beginning of July. At the same time, only 50 of 142 required Oerlikon cannons were available in inventory. Yugoslav Me-109s were not equipped with the third engine mounted cannon.

A wonderful and very rare colour photographs taken in Regensburg, August 1939: (left) the first five Me-109 machines for VV, L-1 to L-5, lined up prior to their flight to Beograd on 15 August 1939. Note that the L-2 code is covered slightly by u/c leg of L-1. (Dénes Bernád); (right) Upper view of two Me-109s at the same time. (Signal)



Me-109 L-1 and L-2 at the same place and the same time. Standing on the right Head of Bayerische Flugzeugwerke Regensburg Theodor Croneiss. Note the same time and scene as on the colour photos. (Marko Ličina via Predrag Miladinović)



14 Me-109s at Regensburg prior to a ferry flight to the Kingdom of Yugoslavia in October 1939. Note the temporary applied swastika in White circle over the Red area on the vertical stabilizers and German civil registrations on fuselages and wings. (Aleksandar Smiljanić)

A close up view of the Me-109s before the ferry flight shows the German civil registrations applied specifically for the occasion. Note that D-IYWZ is applied over darker rectangular area on the fuselage of the second aircraft. This area is covering the original VV L-code using washable paint. (Šime Oštrić)



Minor servicing of Me-109s was conducted at VTZ in Kraljevo while propeller repair was directed to Ikarus factory. Aircraft with serious damage were sent directly to Germany for repairs. In this manner, Germans repaired and returned a total of 15 aircraft of which some were likely not repaired but were replaced with other serviceable aircraft from available stocks.

In May 1940 *mv Ik* Valentin Balaž lost his life when he crashed in a vineyard near Beograd Airport as a result of failing to adjust his propeller pitch during takeoff. On 20 September 1940 *nv IIIk* Nikola Pavkov crashed near Mali Požarevac while flying machine 2562 from 142.E because he forgot to turn on oxygen supply during flight at an altitude of 7 km. On 31 March 1941 *kap IIk* Milan Djordjević from 104.E crashed while landing at Krušedol some 2 km from the runway as he ran out of fuel, the engine stopped and the aircraft dropped from the altitude of 200-300 m. After the RA bombed Bitolj on 5 November 1940, 102.E was sent to Mostar to defend the Yugoslav Navy based in Bocche and it returned to Belgrade on 5 April 1941.

According to VV classification from mid-1940, Me-109 was „једномоторни једносед за гоњење са мотором Дајмлер-Бенц Д.Б.601 од 1100 КС на висини искоришћења 3700 метара“ (single-engine single-seat pursuit aircraft with 1100 mhp Daimler Benz D.B.601 at 3,700 m exploitation altitude), or according to usual to-day classification – single-seat fighter. The engine of Yugoslav Messerschmitts was 12-cylinder inverted-Vee liquid-cooled DB.601Aa with 1175 mhp at take-off, 1,100 mhp maximum (5 min) at 3,700 m, 1,000 mhp cruising at 4,500 m and 970 mhp economic cruising at 3,700 m. Weapons consisted of two synchronized 7.92 mm RB (Rheinmetall-Borsig MG-17) machine guns in the nose with 1,000 rounds per gun (the first nine aircraft had 500 round magazines) and two 20 mm M.39E.K. (Oerlikon FF-K) cannons in the wings with 60 rounds per gun. Reflector gunsight was Oigee Revi 3c/d. The aircraft was equipped with German Telefunken FuG VIIa radio communication set.



In addition to the quality of construction and superb flying characteristics, the main reasons which resulted in VV Headquarters approval for Me-109 introduction in service were the ability to purchase a large quantity and have them delivered in a short period of time. Me-109 was a typical fighter with high altitude engine and had more powerful armament than any other VV fighter in inventory. It was one of the two standard VV fighter types (the second one being the Hurricane) in the period between 1939-1941 and at the same time it was the most numerous one. Messerschmitt fighter represented the most potent weapon the Yugoslav fighter units possessed prior to World War II.

Two shots showing the remains of crashed VV Me-109 L-55 D-IWKU near Regensburg on 15 March 1940. VV codes (L-55) were roughly painted over with washable paints (here seen in light shade), while temporary German civil registrations and German flag were made from removable adhesive labels. (both Aviation Museum – Belgrade)

| Messerschmitt Me-109 equipped VV units | | | |
|--|-----------|-----------|---------------------------------------|
| Unit | Period | Home base | Note |
| 6.LP | 1939–1941 | Beograd | 31.VG, 32.VG, 51.VG |
| 2.LP | 1941 | Kraljevo | Formed 1 April 1941, 31.VG |
| Aviation Groups: | | | |
| 31.VG | 1939–1941 | Beograd | 6.LP, from 1 April 1941 in 2.LP |
| 32.VG | 1939–1941 | Beograd | 6.LP |
| 51.VG | 1939–1940 | Beograd | 6.LP, in April 1941 again used Me-109 |

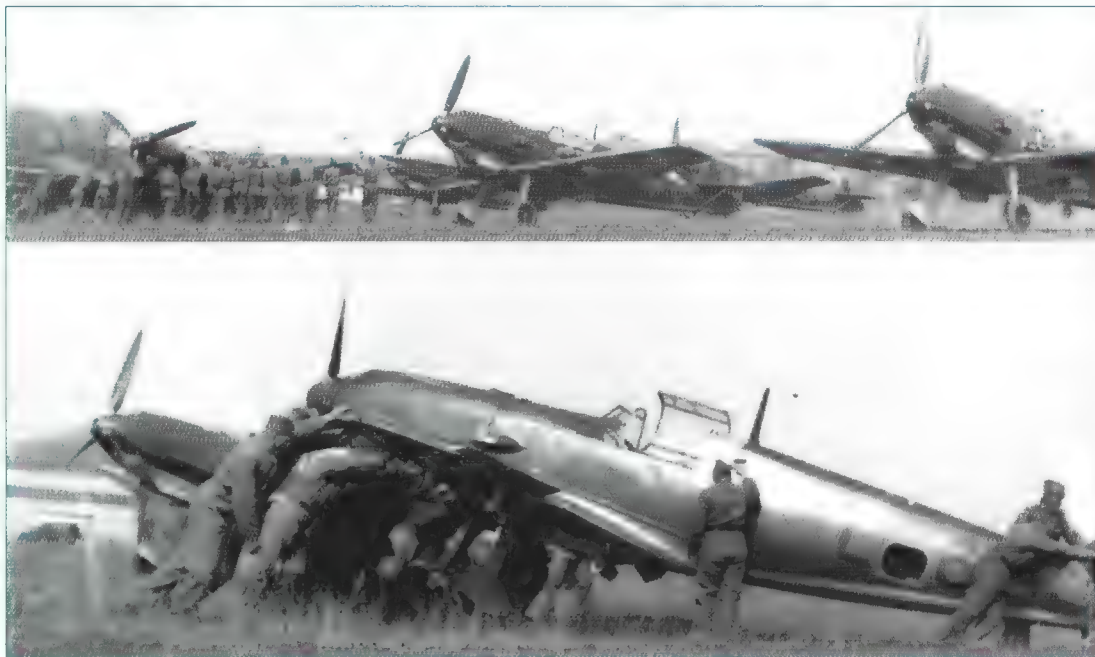
1941 April War

At the beginning of April 1941, VV had 54 operational Me-109s. Two were assigned to 1.LB Headquarters, 31 to 6.LP, 19 to 2.LP and two to 3.PS. One fighter was delivered to 6.LP following repairs during the war bringing the total number of available aircraft to 55. On 6 April, Me-109 fighters from 6.LP were spread out across 51.VG (102.E with nine machines) based at Beograd, and 32.VG (103.E, 104.E and 142.E, all with seven machines, plus Group CO's aircraft) situated at Krušedol auxiliary war airfield. The 2.LP fighters were spread out across 31.VG (101.E with eight and 141.E with ten machines plus Group CO's aircraft) based at Sušičko Polje near Kragujevac.

Awaiting the attack, 6.LP was brought from high readiness to full combat alert status. Already at 04:30 the first patrol (actually a pair, basic fighter element in VV service) with *kap Ik* Miloš Žunić and *nar* Vukadin Jelić took off to scour the east and north-east sector. The next patrol with *kap Iik* Mihajlo Nikolić and *ppor* Miodrag Bošković followed immediately after and landed at Beograd Airport following a 40 minute flight. In the meantime, numerous radio and telegraph messages started arriving indicating that the German attacks commenced on various airfields and border positions. This was soon confirmed when a patrol from 32.VG took off at 05:30 and made contact with the enemy with one of the VV Me-109 sustaining damage. The first formations of German fighters and bombers were confronted by VV Me-109s from both 2.LP and 6.LP, 21 took off from Krušedol, nine from Beograd and 13 from Kragujevac. During the initial attack 102.E lost seven aircraft, which were either destroyed or damaged,



WW Me-109 fighters and pilots in 1940: (left to right) maj Ilija Milovanović CO 31.VG (Milan Micevski); kap Ik Borivoje "Farma" Marković CO 104.E, Beograd, early in the year. (Aleksandar Ognjević; engineer por Boris Cijan, Krušedol (Šime Oštrić); rez por Miloš Drakulić in May (Mario Hrelja).



Me-109s from 103.E prepared for demonstration flight on 27 April 1940: (top) L-3 (W.Nr.2182) and L-8 (W.Nr.2187) had their factory applied state flags removed from the rudder; (bottom) Ground personnel pushing the L-6 (W.Nr.2185). (both City of Belgrade Library)

some of which were able to be repaired. *Escadrille* CO, kap Ik Miloš Žunjić lost his life while attacking alone a formation of Ju 88 from III/KG 51, one of which he most likely shot down. Kap Ilk Mihailo Nikolić and ppor Miodrag Bošković were both wounded but managed to safely return to base on foot. Bošković managed to approach to within 50 m of a Ju 87 which was under attack at the time by the anti-aircraft cannons from Belgrade's Kalemegdan fortress and machine-guns from the Beograd Airport. Following the engagement, this Ju 87 crashed in the confluence of the rivers Sava and Danube. Shortly thereafter one of the escort Bf 109s attacked Bošković and damaged his fighter forcing him to belly-land.

32.VG fighters attacked one enemy formation heading in and one returning back from bombing of Belgrade. Due to the damage incurred in a fight, por Bojan Presečnik, nar Dragoljub Milošević and nar



Me-109 L-7 (W.Nr.2186) prior to take off for a demonstration flight at Beograd Airport, 27 April 1940. (Aviation Museum – Belgrade)



Zvonimir Halambek force landed while *por* Vasa Kolarov was shot down and wounded after he managed to shoot down one Bf 110 and damage another one. Pilots from 32.VG claimed several *Luftwaffe* aircraft shot down. *Kap* *Ik* Milutin Grozdanović, 142.E CO, shot down a Do 17, *ppor* Jovan Kapešić a Bf 110, *por* Otmar Lajh a Do 17, *nv IIIk* Tomislav Kauzlarić a Bf 110 and damaged Ju 88 and *nar* Ivan Rehak damaged a Ju 88. Actions of other Group pilots resulted in damage to further enemy aircraft of which some managed to return to base and some forced landed.

As the outcome of the first attack, VV lost 15 fighters of which three were shot down and 12 seriously damaged. Two pilots died and six were wounded. As a result, 6.LP remained with 25 serviceable fighters, seven in 51.VG (including three IK-3s) and 18 in 32.VG.

The second bombing raid on 6 April was less intense. To counter this attack, three aircraft took off from Belgrade, and nine from Krušedol. *Nv IIIk* Karel Štrbenk died in the engagement after claiming to have shot down a Bf 109 and another Ju 87 was shot down by an unknown Yugoslav pilot with all hands lost. Early afternoon five Ju 88 bombers were attacked by a pair of Me-109s with one of the Yugoslav fighters flown by *nv IIIk* Djordje Stojanović sustaining damage. The last large daylight raid on Belgrade took place at 15:30 with peripheral parts of the city facing the brunt of the attack. Only one Me-109 was serviceable at Belgrade but it did not take off. Instead, 14 Messerschmitts took off from Krušedol. Several pilots attacked one Do 17 allegedly shooting it down, another Ju 87 was shot down by *maj* Stevan Krajinović and three Ju 88s were damaged. Two VV pilots, *ppor* Dobrica Novaković and *nv IIIk* Milutin Petrov died in the attack.

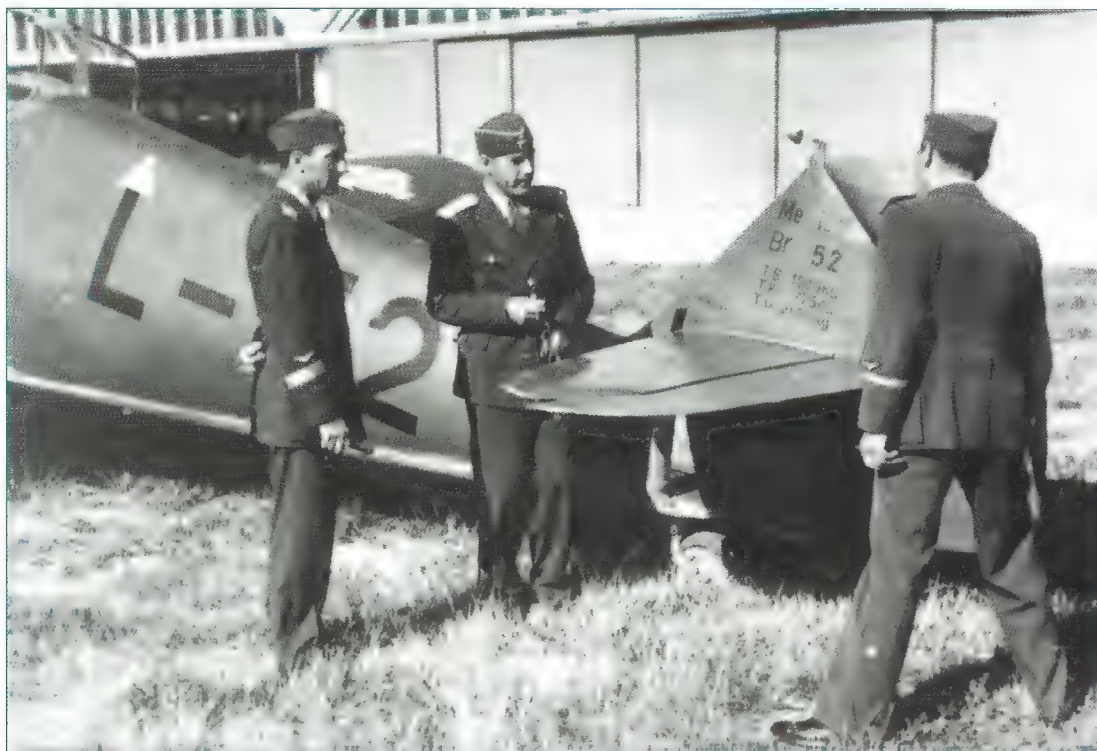
During the first day of the war, Yugoslav pilots flew each on average up to four missions and some aircraft flew up to five times with different pilots. A total of 23 aircraft were lost (eight shot down and

L-7 taxiing prior to take off on the same day. (Djordje Kešeljević family)



Me-109 fighters with and without large flag on the rudders: (top) five machines from 51.VG, all with White fuselage codes, lined up at Beograd Airport in May 1940 (note the three aircraft with and two without rudder flag); (bottom) Canvas covered aircraft at Veliki Radinci auxiliary airfield in the summer of 1940 (both machines still have rudder tri-colour flag). (both Šime Oštrić)

Br.52 L-52 (W.Nr.2347) at Beograd Airport, 18 July 1940, with 101.E CO kap Ik Kosta Lekić on the far left and 31.VG CO maj Ilija Milovanović during a conversation with an unknown Lieutenant. The aircraft designation, number and weights are clearly visible on the vertical stabilizer. Note the original VV two-digit s/n, Br.52. (Djordje Kešeljević family via Milan Micevski)



Another shot during the same occasion. Note the "Kosovo cross" on the starboard wing. (Aviation Museum – Belgrade)



15 damaged), six pilots perished and seven were wounded. A total of 22 fighters remained serviceable with 6.LP.

On the next day of war, 6.LP changed tactics and instead of sending fighters in pairs, flights of five aircraft were ordered to take off with three of the aircraft conducting the attack whereas the other two acted as cover. A total of 19 Me-109s were available and these were based at Krušedol and Beograd and later during the day they used the wartime auxiliary airfield at Veliki Radinci. During the attack at 10:30, three Me-109s took off from Belgrade and further five from Krušedol. *Kap Ik* Milutin Grozdano-*vić* managed to shoot down one Ju 87. At 15:00 *nv IIIk* Djordje Stojanović took off and shot down a Ju 88 but was wounded during forced landing. *Kap Ik* Milan Žunjić attacked several Ju 88s claiming one victory, however German records only claim one was damaged and another force landed in Romania. Eleven Me-109s took off against a formation of Ju 87s and for the first time Yugoslav fighters succeeded in breaking up the enemy formation and preventing the target, a railway viaduct at Krušedol, from being attacked. During this encounter, VV Messerschmitts fought against 24 German Bf 109s and



Messerschmitt fighter pilots from 6.LP, Beograd Airport, May 1940: (left to right) rez ppor Boris Cijan, por Mihajlo Nikolić, rez por Miloš Drakulić, kap Ilk Brativoje Urošević, maj Ilija Milovanović, nar Savo Vujović, kap Ilk Boško Šuković, unknown NCO, unknown officer, nv Ilk Viktor Ulčar, rez kap Ilk Aleksandar "Aca" Stanojević, kap Ilk Miloš Žunjić, unknown officer, and nv Ilk Karel Štrbenk. (Mihajlo Nikolić family via Boris Ciglić)

four Yugoslav pilots perished. One German Bf 109 and possibly one Ju 87 were shot down. Following this encounter, all remaining aircraft from 32.VG were organized in one *Escadrille*.

On 7 April 6.LP Me-109 pilots claimed a total of 12 aircraft shot down, nine by 32.VG and three by 51.VG. A total of seven aircraft from 32.VG were lost and two from 51.VG were damaged. Six of the fighters transferred in the evening to Veliki Radinci airfield, with one damaged during crash landing. Following the relocation of aircraft to avoid destruction at the discovered airfields, 6.LP had a total of 10 Me-109s, two at Krušedol and eight at Veliki Radinci.

On 9 April, only six flights were conducted due to poor weather, and the next day due to the same reason, only eight. On 11 April, *nar* Vukadin Jelić managed to damage one German reconnaissance aircraft at 14:00.

Due to deteriorating war situation and the rumors which circulated among the pilots that the German troops are nearing their position, all aircraft at Veliki Radinci, including eight Me-109s, were torched by their crews of 12 April. Two Me-109s from Krušedol were flown over to Bijeljina however, not long after their arrival, *Luftwaffe* Bf 110 destroyers showed up strafing the airfield and in process destroying the last serviceable Me-109s from 6.LP.

31.VG with its two *Escadrilles*, 101.E and 141.E, relocated on 2 April to Sušičko Polje auxiliary war airfield north of Kragujevac. During this endeavor, only two aircraft were lightly damaged. The aircraft were dispersed upon arrival and well camouflaged. In the early morning of 6 April around 03:30 2.LP CO *ppuk* France Pirc ordered combat alert status whereas already on 6 April at 05:30 a Do 17P enemy was observed in the air nearby. At 05:55 101.E CO *kap* Ik Kosta Lekić ordered that two pairs of Me-109s take off to intercept another intruder. *Por* Ratko Jovčić and *ppor* Nedeljko Pajić from 101.E and *rez ppor* Pavle Crnjanski and *nv* Ilk Josif Brajner from 141. E took off, however they lost the enemy aircraft in the distance.

Kap Ilk Živica Mitrović and *rez por* Dragutin Bojović, allegedly in L-24 and L-23 respectively, took off towards Belgrade to confront the first wave of *Luftwaffe* forces. *Por* Bojović was damaged in combat and was attacked by own forces while trailing smoke and attempting to land, only to abort landing and escape by parachute at low altitude. *Kap* Ilk Mitrović allegedly shot down two enemy Stukas, which is to this day unconfirmed, but was shot down in return losing his life.

Following the order from 1.LB, at 07:30 2.LP immediately sent two patrols from 101.E, one with *kap* Ik Kosta Lekić and *nar* Savo Vujović and an unknown second patrol. Not long thereafter nine aircraft with 31.VG CO Ilija Milovanović and *nar* Aleksandar Cenić in the first patrol, 141.E CO Franc Berginc, *kap* Ik Vladimir Simić and *nvtč* IVk Zvonimir Nikšić in the second, *ppor* Stanislav Kodre and *rez ppor* Pavle Crnjanski in the third and *kap* Ilk Miloš Maksimović and *por* Ratko Jovčić in the fourth and final patrol. As these patrols arrived following the first wave, they did not make contact with the enemy and they returned to Kragujevac. Another ten patrol flights were undertaken by 31.VG during the day and during one of them *ppor* Nedeljko Pajić shot down a Hs 126 north-west of Paraćin. At the same time, the second patrol, *ppor* Kodre and *rez ppor* Crnjanski from 141.E claimed another Hs 126 in the same area. At the end of the day 101.E had six serviceable, one damaged and two destroyed Me-109s while 141.E had nine serviceable aircraft.

Me-109 fighters of 3.PS
(from left) L-13, L-83 and
L-2, Niš Airport, near Me-
doševac, early August 1940.
Note that aircraft have no
wing armament. (Stanislav
Džodžović via Predrag
Miladinović)



Belly landing by kap III
Miloš Žunjić during transfer
flight from Beograd to Crve-
na Crkva, 1 August 1940.
The pilot forgot to lower un-
dercarriage legs of his 2543
L-46. Note that the EvBr and
L-code were not analogous.
(Miloš Žunjić family)

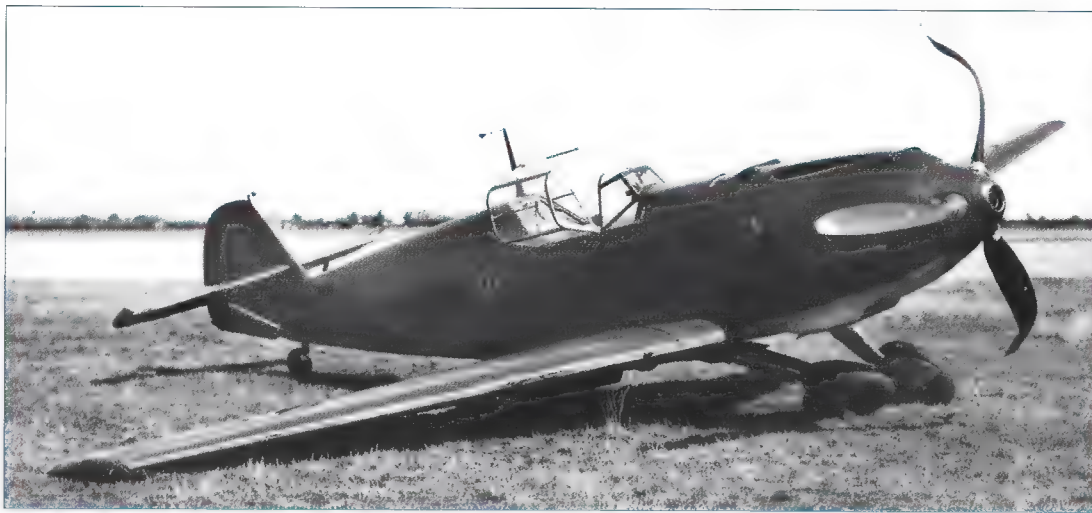


During their use the Me-109
fighters suffered frequent
landing gear breakage. Here
2571 L-88 from 101.E
suffered a landing accident
with rez por Miloš Drakulić
at the controls at Beograd
Airport in September 1940.
(Šime Oštrić)



Another shot of 2571 L-88
accident during training
practice of rez por Drakulić.
(Aviation Museum – Belgrade
via Milorad Ristić)





L-81 from 141.E shown here following a landing accident at Beograd Airport on 13 September 1940 with por Djordje Kešeljević at the controls. (Djordje Kešeljević family via Milan Micevski)

On 7 April, both *Escadrilles* performed only patrol flights due to lack of orders from the 2.LP CO and occasionally chased German Hs 126 which were out on reconnaissance missions.

Due to the rapid advance of German armoured columns, 2.LP received orders on 8 April to strafe the enemy armour coming through Kačanik gorge, but 2.LP CO issued an order for 31.VG to maintain patrol flights, while 52.VG was to attack German armour. As a result, 101.E and 141.E continued patrols but encountered no enemy aircraft. The next day, poor weather conditions prevented any further flights.

Due to the spread of rumors that the German troops have reached Kragujevac, on 10 April 31.VG Messerschmitts were torched at Sušičko polje airfield near Kragujevac, sealing the fate of the last 14 serviceable aircraft. Another two aircraft which were damaged, L-53 and L-74, were not destroyed and were captured when the German forces finally arrived.

The Mostar-Kosor based 3.PS fighters, Me-109 L-2 with *kap Ik* Zlatko Stipčić and L-13 with *nar* Blagoje Grujić along with three Hurricanes, engaged in the morning of 6 April 11 Cant. Z1007bis bombers from 35° *Stormo* which were guarded by 12 Macchi C200 from 370° *Squadriglia*. Messerschmitt pilots did not score any hits but the Hurricane pilots claimed two Italian aircraft. Following combat, pilots returned to their airfield which was flown over now by German forces which bombed Rajlovac with 22 Ju 88As from Stab and III./LG1 escorted by 15 Bf 110s from III./ZG.26. *Nar* Grujić's Me-109, with no ammunition left, was hit by the attacking Bf 110s and trailing smoke he managed to dive and avoid further attempts to get shot down. L-2 and L-13 took off again along with a Hurricane around 11:30 to face the Italian bombers. *Nar* Grujić scored a victory against a Cant from 261° *Squadriglia* while *kap Ik* Stipčić damaged another bomber from 260°. Grujić's Me-109 was heavily damaged with over 100 hits but the pilot managed to land the aircraft, which was damaged too extensively and was used as a decoy throughout the remainder of the war. During the last attack of the day around 14:40, L-2 with *kap Ik* Stipčić at the controls damaged a Ju 88A from 8/LG1 which crash landed at its airfield. *Kap Ik* Stipčić was bounced on landing by one Bf 110 and incurred only slight damage which was repaired the next day.

On 7 April there are no recorded actions by aircraft from 3.PS but on the next day *kap Ik* Stipčić took off in L-2 again to intercept a low flying aircraft, fortunately without attacking it as it was a friendly Savoia Marchetti SM.79 from 7.BP 212.E. The same pilot intercepted friendly Savoias from 7.BP on 10 April which were coming in for a landing at Mostar and again broke off the attack once he recognized them. Due to the worsening war situation and the Croat rebels which took charge of Mostar, further flights on that day by 3.PS were not possible until 12 April when loyal troops temporarily freed the city. *Kap Ik* Stipčić in L-2 and *nvtč IVk* Franc Godec in a Hurricane took off to find the alleged Italian motorized column. Stipčić returned to Mostar while Godec was shot down while trying to attack a Ju 88.

The last operational VV Me-109 L-2 was damaged beyond repair on 13 April during the Italian attack by seven Ju 87s from 208° *Squadriglia*, C200 from 150° *Gruppo* and FIAT CR.42 from 160° *Gruppo*. The remains of these aircraft along with the remains of other VV aircraft were moved upon capture of the Mostar Airport by the Italians to one of its hangars.

A total of 23 Me-109s were lost in combat and seven in accidents, one in friendly fire incident and 21 were torched by own crews to prevent capture by the advancing German forces. At the end of the war, a total of seven VV Me-109s were captured by Germans. Four were captured at Krušedol, including W.Nr.2188 and W.Nr.2400, three at Sušičko Polje including W.Nr.2323, 2348 and 2414 as well as four fuselages at VTZ Kraljevo including 2519 and 2526. L-2 was captured by the Italians and was used as a source of spare parts to complete a German example of the same fighter, which they discovered at an unknown location.

| VV Me-109 – Order of Battle 6 April 1941 | |
|--|--------------------------------|
| 1.LB (CO <i>puk</i> Dragutin Rubčić) | 2 Me-109s |
| 6.LP (CO <i>ppuk</i> Božidar Kostić) | |
| 51.VG (CO <i>maj</i> Adum Romeo) | |
| Beograd Airport | 1 P.630, 1 P.631 |
| 102.E (CO <i>kap</i> Ik Miloš Žunjić) | 9 Me-109s |
| 161.E (CO <i>kap</i> Ik Todor Gogić) | 3 IK-3s |
| 162.E (CO <i>kap</i> Ik Sava Poljanec) | 3 IK-3s |
| 17.AČ (CO <i>kap</i> Ik Mihailo Djordjević) | - |
| 32.VG (CO <i>maj</i> Danilo Djordjević), Krušedol auxiliary war airfield | 1 Me-109 |
| 103.E (CO <i>kap</i> Ik Ilija Vlajić) | 7 Me-109s |
| 104.E (CO <i>kap</i> Ik Borivoje Marković) | 7 Me-109s |
| 142.E (CO <i>kap</i> Ik Milutin Grozdanović) | 7 Me-109s |
| 16.AČ (CO <i>kap</i> Ik Josip Helebrant) | - |
| 2.LP (CO <i>ppuk</i> France Pirc) | |
| 31.VG (CO <i>maj</i> Ilija Milovanović), Sušičko polje auxiliary war airfield near Kragujevac | 1 Me-109 |
| 101.E (CO <i>kap</i> Ik Kosta Lekić) | 8 Me-109s |
| 141.E (CO <i>kap</i> Ik Franc Berginc) | 10 Me-109s |
| 15.AČ (CO <i>kap</i> Ik Jovan Miljković) | - |
| 3.PS (CO <i>maj</i> Vladimir Tihomirov) | |
| 2 nd Detachment, Kosor auxiliary war airfield near Mostar | 4 Hurricanes Mk.I 2 Me-109s |

| VV Me-109 in 1941 April War (reconstruction) | | | | | | | | | | | |
|--|-------------------|-------|---|-------------------------|-------|--|-------------------------|--|---------------|--|-------------|
| Unit | 1.LB | 2.LP | | | 6.LP | | | | | | 3.PS |
| | | 31.VG | 101.E | 141.E | 32.VG | 103.E | 104.E | 142.E | 51.VG | 102.E | |
| Me-109 fighters | L-55** +1 unk. | L-33* | L-16 L-23 L-24 L-31 L-32 L-67 L-74 +1 unk. | L-53 L-82 +8 unk. | L-4** | L-22 L-26** L-35 L-61 L-63 L-65 L-69 | L-15 L-28 +5 unk. | L-5 L-7 L-9 L-10 L-52 +2 unk. | no Me-109s | L-8 L-25 L-44 L-45 L-46 L-54 +3 unk. | L-2 L-13 |
| Total | 2 | 1 | 8 | 10 | 1 | 7 | 7 | 7 | - | 9 | 2 |
| Operational Me-109: 54 | | | | | | | | | | | |

* Black L and White 33; ** all White; unk. – unknown code

| VV fighter pilots lost flying the Me-109 during 1941 April War* | | |
|---|-------------|-----------------------------------|
| Rank, name and surname, role | Unit | Date and place of death |
| <i>kap</i> Ik Živica I. Mitrović | 31.VG, 2.LP | 6 April (L-24), Belgrade |
| <i>kap</i> Ik Miloš T. Žunjić CO 102.E | 51.VG, 6.LP | 6 April (L-25), Pančevo |
| <i>por</i> Dobrica R. Novaković | 32.VG, 6.LP | 6 April (L-35), Pančevo |
| <i>mv</i> Ik Karel F. Štrbenk | | 6 April (L-55), Glogonjski rit |
| <i>kap</i> Ik Miha T. Klavara | | 7 April (L-26), Irig |
| <i>ppor</i> Jovan Đ. Kapešić | | 7 April, Beška |
| <i>mv</i> Ik Vladimir Z. Gorup | | 7 April (Br.2505/L-5), Gardinovci |
| <i>mv</i> Ik Milutin L. Petrov | | 6 April, MIA |
| <i>nar</i> Milivoje M. Bošković | | 7 April, Kovilj |
| <i>nvtč</i> IVk Branislav S. Todorović | | 7 April, MIA |

* Belgrade defense.



Camouflage and Markings

Type designation

The official VV designation was simply Me-109. Other designations such as Me-109E, Me-109 DB 1100 KS, *Meseršmit* (Messerschmitt) 109 and *Meseršmit* Me-109 were sometimes used, while the aircraft was nicknamed *Meser* (Messer).

Ferry registrations and c/nos

During the ferry flights, German factory applied codes were covered with washable paints and over them a German civilian registration codes in the form of a Black coloured stickers were applied to both the fuselage and the wing undersides.

From the delivered Bf 109s, some were ferried over by air and some were delivered by rail. The following ferry registrations are known: D-IWKU, D-IYUA, D-IYUB, D-IYUI, D-IYUL, D-IYUM, D-IYUN, D-IYUR, D-IYUI, D-IYUU, D-IYUY, D-IYWD, D-IYWI, D-IYWZ, D-IYYJ, D-IYYN and D-IYYP. Information concerning the W.Nr. is also very scarce and from the available documents only partial reconstruction of W.Nr., ferry registration and code numbers are available.

Serial numbers and Codes

Me-109 aircraft had factory applied serial numbers, starting with Br.1, and code numbers, starting with L-1 painted in *Schwarz* RLM 22. The L codes indicated fighter aircraft (L – *Ловац* or fighter). In accordance with the contract, the numbers L-1 to L-100 were reserved and Germans used them for the delivered aircraft.

From the beginning of 1940, new EvBr (starting from 2501) were assigned while retaining the original L numbers. Few numbering exceptions took place, specifically where L-33 had Black letter L and White number 33 and L-4 which had all White letters and numbers.

On the port side of the vertical stabilizer, as was the usual practice of the VV at the time, aircraft specifications (VV designation and aircraft weights) were applied in Black letters.

Insignia

In accordance with standard German export practices at the time, the aircraft had a large German flag and swastika applied across the vertical stabilizer and the rudder. VV insignia (standard “Kosovo cross”) was factory applied, by Yugoslav specification, initially on four wing positions whereas later, asymmetrical insignia were applied although this was not followed in practice on all aircraft. There were many machines with insignia on the port wing upper side and two “Kosovo crosses” under the both wings. The first delivered aircraft carried a large Yugoslav Blue-White-Red tri-colour on the rudder which was later painted over.

*Pilot kap Ik Kosta Lekić
CO 101.E posing with two
Me-109s in a hangar at
Beograd Airport. (Mario
Hrelja)*

Two VV Me-109s: (top) ground crew sitting on 87 octane fuel barrels with L-68 in the background (Robert Čopec); (bottom) L-65 at Beograd Airport with pilot kap IIk Josip Helebrant in the cockpit. (Šime Oštrić)



Tactical markings

During the April War, to better distinguish the friendly Me-109s from the German ones, the aircraft of 141.E as of 7 April had White coloured circles hastily applied around the VV insignia on the wings surfaces and had the entire rudder painted White as well.

Stencils

Analogous to the *Luftwaffe* standard, Yugoslav Me-109s carried the factory applied service inscriptions in Serbian language, specifically in Latin letters. These included: NE DIRAJ (do not touch), NE GAZI (no step), ZA RUKU (for hand), DIŽI OVDE (lift here), OVDE PODUPRTI (support here) and so on. In accordance with the same standard, fuel access openings were marked with Yellow triangle outlined with a White line.

Camouflage scheme

All VV Me-109 fighters had their camouflage applied at the factory prior to delivery. Standard camouflage consisted of German *Schwarzgrün* RLM 70 applied on topsides and propeller blades and *Hellblau* RLM 65 applied on the undersides. The trimmers on the ailerons and elevators were painted in *Weinrot* RLM 28.

| Aircraft Characteristics* Messerschmitt Bf 109 E-3a (VV Me-109) | |
|---|--|
| Quantity used: | 73 |
| Crew: | 1 |
| Years of Service: | 1939-1941 |
| Span: | 9.9 m (32.4 ft) |
| Length: | 8.8 m (28.7 ft) |
| Height: | 3.4 m (11.2 ft) tail up |
| Wing area: | 16.4 m ² (176 ft ²) |
| Engine: | One 1,175 mhp (1,159 hp) Daimler Benz DB.601Aa |
| Empty weight: | 2,010 kg (4,432 lb) |
| Loaded weight: | 2,610 kg (5,755 lb) |
| Maximum speed: | 570 km/h (354 mph) at 5,000 m (16,405 ft) |
| Cruising speed: | 338 km/h (210 mph) |
| Service ceiling: | 11,000 (36,091 ft) |
| Climb to 6,000 m: | 6 min 18 s |
| Range: | 660 km (410 ml) |
| Armament:** | Two synchronized 7.92 mm RB (Rheinmetall-Borsig MG.17) machine guns and two 20 mm M.39E.K. (Oerlikon FF-K) cannon in wings |

* Specification mainly according to the official VV Me-109 Manual, 1940.

** One of the four prototypes of the Mikron-built (Jansen-Matović designed) "H 24x2" bomb racks for 24 kg anti-personnel bombs was experimentally tested on one VV Me-109 fighter.

| Yugoslav Me-109 (Bf 109E-3a) W.Nr. (known data)* | | | | | |
|--|---------|-----------------------|-----------|---------|-----------------------|
| W.Nr. | EvBr | Code/ Registration | W.Nr. | EvBr | Code/ Registration |
| 2179 | 2501 | L-1 | 2345 | unknown | L-50 |
| 2181 | 2502 | L-2 | 2347 | unknown | L-52 |
| 2182 | 2503 | L-3 | 2348 | 2555 | L-53 |
| 2183 | 2504 | L-4 | 2350 | unknown | unknown |
| 2184 | 2505 | L-5 | 2365 | unknown | unknown |
| 2185 | 2506 | L-6 | 2366 | unknown | unknown |
| 2186 | 2507 | L-7 | 2368-2370 | unknown | unknown |
| 2187 | 2508 | L-8 | 2391 | unknown | unknown |
| 2188 | 2509 | L-9 | 2393-2398 | unknown | unknown |
| 2314 | unknown | unknown | 2400-2402 | unknown | unknown |
| 2315 | unknown | unknown | 2410-2413 | unknown | unknown |
| 2317-2321 | unknown | unknown | 2414 | unknown | L-74 |
| 2322 | unknown | D-IYWD | 2415 | unknown | unknown |
| 2323-2327 | unknown | unknown | 2416 | unknown | unknown |
| 2329-2333 | unknown | unknown | 2483-2485 | unknown | unknown |
| 2334 | unknown | D-IYYN | 2498-2500 | unknown | unknown |
| 2335 | unknown | L-27/D-IYYP | 2502 | unknown | unknown |
| 2336-2342 | unknown | unknown | 2503 | unknown | unknown |
| 2343 | unknown | L-48 | 2505-2507 | unknown | unknown |
| 2344 | unknown | L-49 | | | |

* According to Boris Ciglić, Dragan Savić, Milan Micevski and Predrag Miladinović book *Messerschmitt Bf 109 The Yugoslav Story Volume I*, 2016.

Some details of one fight

Generally, Me-109 was the only VV fighter type in April 1941 equipped with a radio set. During the April War VV Me-109 equipped units were assigned the following call-signs for radio communication: all *Escadrilles* from 32.VG were *Jastreb* (Hawk), 101.E was *Sivi Soko* (Peregrine Falcon), 141.E *Beli Orao* (White Eagle) and 102.E *Strela* (Arrow). During actual radio-communications two of the call-signs were shortened often to *Soko* and *Orao* and sometimes, they were only called out by the code number.

Excerpts from radio-communications between *kap IIIk* Živica Mitrović and *rez por* Dragutin "Mlad-ja" Bojović during a combat flight in the early morning of 6 April 1941 (as witnesses listening from the other radio-stations remembered) are as follows: "...31st Aviation Group, ground radio-station: Come

back urgently. Germans are bombing Kragujevac... Mitrović: That's a bluff. We will return. We are heading to Belgrade... Bojović: Živica look out towards the northern horizon, maybe it is German?... Mitrović: Of course it is... Bojović: Shall we report to the Commander?... Mitrović: Do you believe that Regiment HQ did not learn of the attack?... Follow me, we will attack! 23rd, 24th here, can you hear me? Ready for attack!... Bojović: I understand. Ready for attack... Mitrović: Weapons are armed! Stukas over Kalemegdan, did you see?... Bojović: Yes, yes, I see... Mitrović: Cover me, I'm attacking!... Heh, watch now!... 23rd answer to me? Pull the stick toward yourself! 23rd... bail out! I will cover you..."

According to the memories of *maj* Djordje Lukić, Kragujevac's 652.AA battalion CO during the April 1941, who listened from his unit radio station the communication between 31.VG fighter pilots in the air and their ground radio station: "... Enemy group with eight aircraft is heading from Belgrade... We are over Arandjelovac. We located the enemy group. We are regrouping for an attack. We are attacking! ... Rough fight! They outnumber us! ... One enemy aircraft shot down! It seems that the pilot survived. The parachute opened! ... Go ahead! *Sivi Soko* patrol is coming... Groups were broken but continuing to hold in the southern direction. We are fighting one against two!... Reinforcements from fighter protection! One enemy aircraft again shot down! Enemy changed direction: to the west then towards the north! ... Let *Escadrille* come back because they are running out of fuel! ... Patrol keeps chasing! ... Get out and return: 15, 10, 8, 4 minutes!"

Nv IIIk Djordje Stojanović in a White flying suit posing in front of his fighter. He was the top-scoring VV fighter pilot with four claimed kills (one was shared with kap Ik Todor Gogić). (Aviation Museum – Belgrade)



Pilot kap Ik Borivoje "Farma" Marković is sitting in the cockpit of L-23, while 7.9 mm RB (MG-17) machine guns are re-armed by a mechanic. (Aleksandar Ognjević)

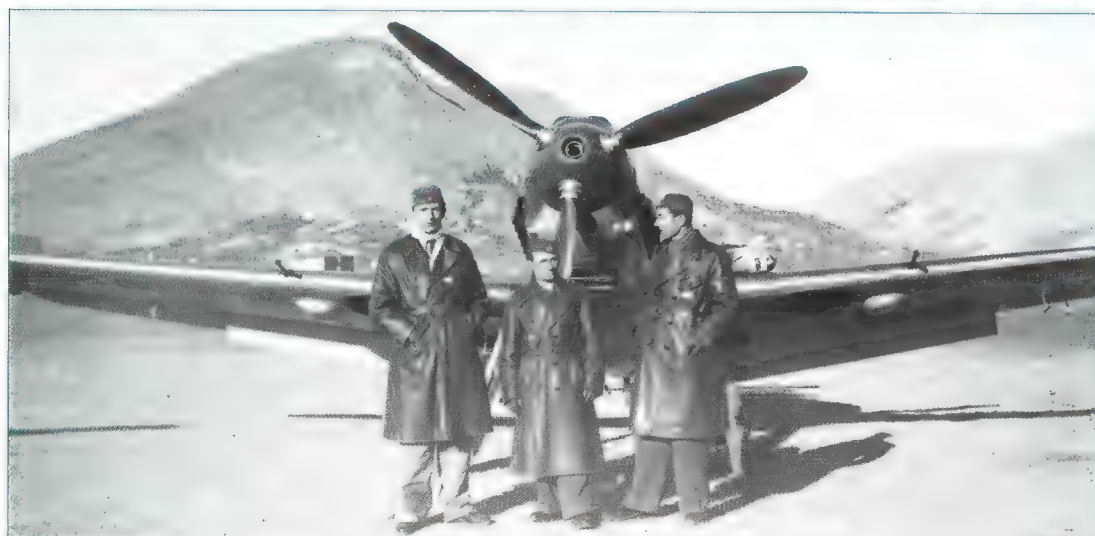




*L-68 in between flights.
Note the engine hand crank.
(Robert Čopeć)*



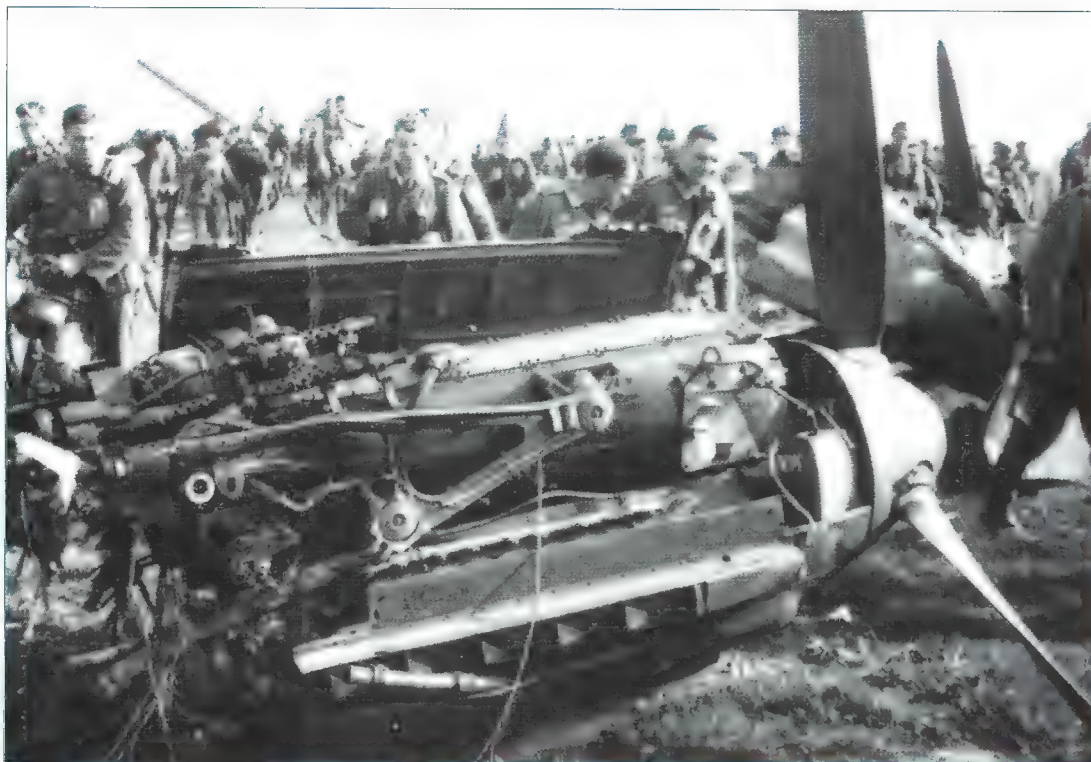
*Nar Aleksandar Janković,
flying instructor of 3.PS, at
Kosor auxiliary war airfield
near Mostar next to L-13
in late March 1941. The
machine in the background
is L-2 (via Milan Micevski)*



*Three pilots from 102.E,
Jasenica-Mostar, late 1940:
(left to right) Unit CO kap
Ilk Miloš Žunjić, por Milan
Skendžić and nar Savo Vujo-
vić. (Miloš Žunjić family)*



Remains of totally destroyed Me-109 fighters from 141.E 31.VG 2.LP at Sušičko Polje auxiliary war airfield near Kragujevac, immediately after the April War: (top) Newly introduced tactical markings (hastily hand painted White rounded area around the "Kosovo cross") on aircraft from 31.VG are clearly seen on the top of the port wing. (Miloš Milosavljević); (bottom) Wehrmacht soldiers looking at the sad remains (note the insignias surrounded in White colour on the upper side of the port and lower side of the starboard wings). (Boris Ciglić)

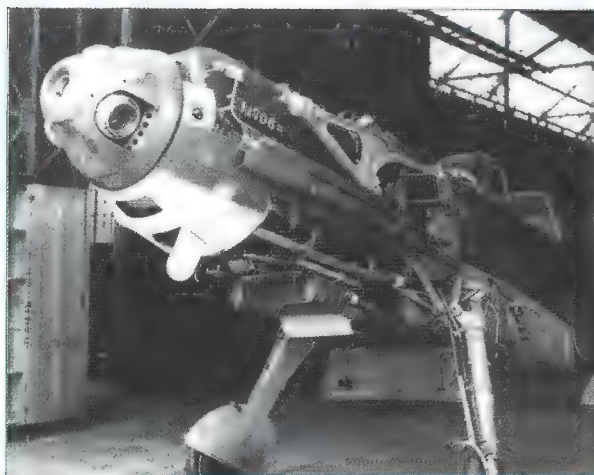


The curious Wehrmacht soldiers of 10. Panzer Regiment look at the remains of the destroyed VV Me-109 at Veliki Radinci auxiliary war airfield on 12 April 1941. Seven Me-109s, three IK-3s, six Hurricanes and sole IK-2 and a captured Bf 110 were amongst the aircraft destroyed by retreating crews hours before German troops arrived. (Djordje Nikolić)

Hungarian officer carefully inspected captured VV Me-109 2515 L-15 at Krušedol auxiliary war airfield following the April War. This machine was damaged on 7 April and survived the war. Note the absence of wing cannons. (Military Museum – Belgrade)



The last fighter from 3.PS and the last operational VV Me-109, 2502 L-2, Italian war booty, pictured at hangar at Jasenica-Mostar: (left) With dismantled wings, removed cowlings, propeller and tires (Giancarlo Garelo via Aleksandar Ognjević); (right) Fuselage on the hangar floor clearly shows L-2 code and tail inscriptions. Remnants of Zmaj-built Hurricane from 164.E, 52.VG, 2.LP are visible in the background. (Giancarlo Garelo via Šime Oštrić)



Messerschmitt Bf 109E-3a (Me-109) Br.2504 L-4, 32.VG, 6.LP, VV, Krušedol auxiliary war airfield, April 1941. Pilot Group CO maj Danilo Djordjević.



Artwork by
Ognjan M. PETROVIĆ
№702/15

All VV Messerschmitts were painted with Schwarzgrün RLM 70 applied on the topsides and propeller blades and Hellblau RLM 65 applied on the undersides.



Bayerische Flugzeugwerke logo.



Messerschmitt logo.



Mercedes-Benz logo.



Artwork by
Ognjan M. PETROVIĆ
№693/15

Messerschmitt Bf 109E-3a "White 11", 51.VG, 6.LP, VV, Beograd Airport, spring 1940.

Messerschmitt Bf 109E-3a WNr.2343 Br.48 L-48, 162.E, 51.VG, 6.LP, VW, Beograd Airport, March 1940. Pilot Escadrille CO was kap Ilk Zlatko Stipčić. The 51.VG left the 6.LP in July 1940 and became an independent group.



Artwork by
№703/15
Ognjan M. PETROVIĆ



Artwork by
№690/15
Ognjan M. PETROVIĆ

Messerschmitt Bf 109E-3a Br.2543 L-46, 102.E, 31.VG, 6.LP, VW, 1 August 1940. Pilot Escadrille CO was kap Ilk Miloš Žunjić.



Artwork by
№908/19
Ognjan M. PETROVIĆ



Three shots of 2530 L-31 from 101.E at Krušedol auxiliary war airfield, imminently prior to the April War: (left top) kap Ik Kosta Lekić CO 101.E and kap Ilk Živica Mitrović (behind) are seated to the left. In the background is L-33 with Black "L" and White "33". Note the absence of "Kosovo cross" on the top of the starboard wing (Milan Micevski); (left bottom) kap Ik Lekić in front of L-31. Note "Kosovo cross" on both wing undersides. (Aviation Museum – Belgrade); (right) The same scene at the same time: L-31 ready to take off with parachute on the wing. (Milan Micevski)



Waiting for war, Knusedom, March 1941:
 (left) kap Ik Kosta Lekić and kap Ilk Žvi-
 ca Mitrović during a discussion (note EvBr
 2530 on the L-31 in the background);
 (right) kap Ik Lekić posing in front of L-31.
 (both Milan Micevski)



Plan views of 2530 L-31. The machine carried semi-symmetrical insignias with three "Koso-
 vo cross" insignia, one on the port wing upper surface (according to the rules) and two below
 the wings which remained unchanged from the previous period (opposite of the rules).





Artwork by
Ognjan M. PETROVIĆ
№ 701/15

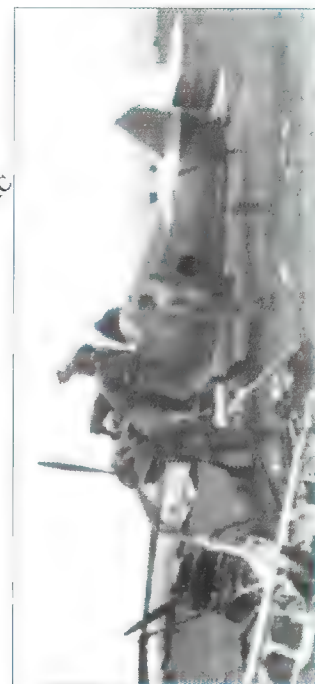
The machine carried standard code, EvBr and tail inscriptions, while the entire rudder was repainted in White colour by 2.LP ground personnel, who wanted to create some type of tactical markings.



Me-109 2555 L-53 from 141.E at Sušicko Polje, after the April War: (top) German soldier poses in the cockpit without canopy. Note the large White circle on the top of starboard wing around the "Kosovo cross"; (bottom) Picked off by souvenir hunters, L-53 is in a poor state at the end of spring of 1941 (note the dismantled cowlings, canopy, tires and other parts and removed under wing panels with White paint surrounding the "Kosovo cross"). This aircraft was set alight by own crew on 10 April 1941 but was not completely destroyed. (both Djordje Nikolic)

Upper and under side views of Br.2555 L-53.

L-53 had four original, factory applied 60 cm diameter "Kosovo crosses" and large White circles with approximate diameter of 120 cm painted around them, as tactical markings.



Two shots of abandoned and heavily scavenged L-53 at Sušičko Polje airfield, early June 1941 (both Djordje Nikolic)



Potez 63

Background

During the 1930s, the military and aeronautical cooperation between France and KJ almost entirely stopped. At the beginning of 1937 the French offered their Potez 63 fighters to the VV. At the time, the order never materialized however at the end of 1937 a contract was finally signed for the acquisition of Potez 63s. The low level of cooperation between the KJ and the Republic of France was evident from the fact that the French aeronautical industry displayed only two Hispano Suiza 14Aa engines at the First International Air Exhibition at Belgrade held between May and June 1938. The French defense industry was maximally involved in the production of aircraft for the French Air Force and as a result VV could not rely on any substantial orders between 1937 to 1939. As soon as World War II began, the possibility to place any orders from France completely disappeared. The only countries in Europe which were still receiving aircraft from France were Finland and Turkey.

In spite of the war situation, France managed to deliver to the Kingdom 54 Renault R-35 tanks in April 1940, two Potez 63 heavy fighters and two out of 30 Gnôme et Rhône 14N 38/39 radial engines intended for use in the Yugoslav twin engine IK-5 fighter. As a result, Potez 63 was the only modern French aircraft in VV service before the beginning of World War II.

It is interesting to note that the French proposed to the KJ a joint license production of some of the modern French aircraft types, both for domestic and French needs. This unofficial offer was received coincidentally on the day of the German invasion of France by the General Manager of Ikarus A.D. Dimitrije P. Konjović and engineer Dušan S. Brakus. As France fell in June 1940, this prospect was never materialized.

Also, the delivery of the promised 25 Morane Saulnier MS.406 C1 fighters never materialized because at the time of the planned delivery in the spring of 1940, France had no means to fulfill the obligation.

Development and production

Potez 63 was developed by a legendary French factory *Avions Henry Potez* as a response to the Specification issued on 31 October 1934 which required a twin engine multi-purpose light defense multi-seater (*multiplaces légers de défense*). The main designers working on this project were engineers Louis Coroller and André Delaruelle. The first prototype, Potez 63 №1 c/n 4330 powered by 580 mhp Hispano Suiza

Aft view of Potez 63 showing the F-AREY registration in standard large Black letters across both the port and the starboard wing. This photograph was most likely taken in France prior to delivery to VV. (MMP)





radial engines, took off on 25 April 1936. The same year, the French aeronautical industry was nationalized and as a result on 23 December 1936, concern S.N.C.A.N. (*Société Nationale Constructions Aéronautiques du Nord*) was created amalgamating five factories which included Potez factories at Méaulte and Sartouville. The new entity continued the development, hence the second prototype, designated Potez 631 C3 №01 c/n 4530, was completed and flew on 15 March 1937. This machine used somewhat less powerful Gnôme et Rhône radial engines since this make was preferred by the French Air Force.

Interestingly, engineer Corroler, Technical Manager of S.N.C.A.N., published in 1939 an article in Yugoslav Aviation Yearbook. Titled as "Testing of Aircraft Characteristic in Flight" the article described test procedure conducted on Potez 630 №1 with loaded weight of 3,790 kg. With elegant lines, good handling characteristics and excellent flying qualities, the Potez 63 proved it possesses multi-role capabilities.

The total production according to different versions included 88 Potez P.630 C3 (*Triplace de Chasse*) fighters, 215 P.631 C3 fighters, 71 P.633 B2 light bombers (*Bombardement Biplace*), 61 P.637 A3 (*Armée Triplace*) reconnaissance aircraft and 863 (of 1514 ordered) of the new Potez 63.11 A2 reconnaissance models. S.N.C.A.N. also received orders for 58 aircraft from five countries: China (four P.631 C3 and five P.633 B2), KJ (two P.630 C3, one P.631 C3), Romania (20 P.633 B2), Greece (24 P.633 B2) and Switzerland (one P. 630 C3 and one P.633 B2). By August 1939 only 36 aircraft were exported to four of the countries: Switzerland received two, KJ one, Romania 20 and Greece 13. Additionally, Czechoslovakia expressed interest to produce the C3 version under license as Potez 636, but this never took place due to annexation by Germany. After the beginning of World War II, France did not export any Potez 63, the only exception being one machine delivered to the KJ.

Potez 630 C-3 F-AREY just after delivery to VV. The aircraft arrived in overall natural Aluminum livery with only the Black registrations applied in standard positions. Behind it is VV Dornier Do-17Ka-1 bomber. (Aviation Museum – Belgrade)



Yugoslav Potez 630 C-3 after delivery, still in overall Aluminum with Black Hispano Suiza license-built Hamilton propellers with two thin stripes and a Hamilton logo. Note that engine cowlings are off and that the aircraft is undergoing maintenance. Two engineers are standing in front of the machine, OFEMA Belgrade representative Dušan S. Brakus (the second from the right, with the hat) and Borislav V. Milojević from KV (the second from the left). (Aviation Museum – Belgrade)

Introduction into VV service

The first mention of Potez 63 in the KJ was in mid-1936, when this type was first considered by the VV acquisitions committee which looked for a modern bomber aircraft type. From five contending aircraft, three were French, and one of them was a bomber version Potez 63 B2 which was at that point still under development. At the time, this Potez type was not selected and the idea was shelved until the next year. It is interesting to note that Aviation Herald no 11/1936, published a short text with description, data and three view drawings of Potez 63, only 6 months after the prototype took off.

In the mid 1937, the KJ expressed interest for a new Potez twin engine aircraft. Accordingly the French sent on 20 October 1937 a quote for a three-seat fighter (C3) and two-seat bomber (B2) versions. In addition to the aircraft, the quote included also all relevant equipment and weapons. The KJ was given permission to place an order for a small number of aircraft and on 31 December 1937 a contract was signed with S.N.C.A.N. Unfortunately, it is unknown how many aircraft were ordered. It is possible, as stated in the report listing condition and aircraft orders issued on 26 September 1938, two Potez 63 were in delivery process while the order included as many as 27 "battle multiplaces". Obviously, this quantity corresponded with VV plans to form new destroyer equipped aviation group.

All of the official correspondence between the KJ and France relating to the aircraft purchase was conducted by Belgrade branch of the French export institution O.F.E.M.A. (*Office Francais d'Exportation de Matériel Aéronautique*), which was based in Paris. This branch began working in Belgrade in 1938 and its representative was Yugoslav engineer Dušan S. Brakus.

A whole year has passed until the contract was fulfilled. As late as the end of December 1938, French CRAS (*Centre de Réception des Avions de Serie* – Center for Series Aircraft Reception) at Méaulte factory conducted testing of two Potez 63s destined for the KJ. A total of 44 Potez 630s and 28 Potez 631s were delivered until the end of 1938 to the French fighter units. The first of the two aircraft, Potez 630 C-3 №1Y (c/n 4530) was assigned registration code F-AREY and it arrived to the KJ at the beginning of 1939 with pilot Lepreux at the controls. The French registration was used only for transfer flight and was removed upon delivery. In accordance with the factory practice, the aircraft was given designation Potez 630 C-3 №1Y, where Y stood for *Yougoslavie*. On 19 April 1939 S.N.C.A.N. invoiced the expenses for *l'avion Potez 63 C-3 no 4530 complet no 1* with Hispano Suiza type 14Ab engines No8565 and No8566 with the value of the aircraft on the invoice listed at 8,778.10 British pounds. This aircraft featured dual controls, which were a Yugoslav requirement.

The second aircraft, c/n 4531, was assigned registration F-AREZ, and it unfortunately crashed on 9 January 1939 near Villacoublay during the last technical check flight prior to delivery to KJ. At the time of the crash, the aircraft was flown by pilot R. Letierce and the event was documented with a photo of the crash in the daily newspaper *Le Progrès de la Somme* on 10 January as the crash location was close to pilot's birth place. Its engines were repaired and were used on the new machine, c/n 4971, built for KJ as a replacement. On 17 October a letter from Paris was received stating that the second Potez 630 will be shipped out and a month later, on 19 November, a telegram was received that the first flight took place, followed by another telegram on 23 November that the aircraft will be delivered as long as overall testing proves satisfactory. On 4 December 1939 S.N.C.A.N. received a certificate from the French authorities for Potez 631 C-3 *Gnôme Rhône No4971 avion No2Y* with engines No20078 and No20079. After numerous delays, this aircraft was finally delivered in January 1940, flown by an unknown pilot and with unknown civil registration code.

Potez 631 Br.2072 covered with branches at Veliki Radinci auxiliary war airfield during a deployment in the summer of 1940. Pilot kap Ilk Dimitrije Leščenko is seen here sitting beneath a sun cover. Note Black VV s/n 2072 on the vertical stabilizer and "Kosovo cross" on the under side of the starboard wing. (Šime Oštrić via Ognjan Petrović)



VV order included one two seat training Potez, the pre-series Potez 630 DC №4 (DC stood for “*double commande*”). Unfortunately, even though this machine was manufactured to fulfill the Yugoslav order, due to start of World War II, it was requisitioned by the French Air Force and was as a result never delivered. After the war began, France exported only one Potez 63, the 37th exported aircraft of the time and the second Potez 63 for the VV, as the French government forbid aircraft and weapons exports. This aircraft was delivered in January 1940. During that time S.N.C.A.N. almost completed the orders for Potez 630 and 631, delivering during 1939 40 and 179 machines respectively. Only three machines of these two types, one Potez 630 and two Potez 63s, followed in 1940. The French Air Ministry (*Ministère de l’Air*) refused on 26 September 1939 to permit the sale of Hispano Suiza type 404 (HS 404) cannons along with 25 Morane-Saulnier MS.406C1 fighters, however it authorized the sale of the second Potez 63 with Gnôme et Rhône engines and Hispano type 9 (HS 9) cannons. VV Headquarters accepted on 6 October 1939 HS 9 cannons instead of HS 404.

According to the report submitted to the Yugoslav Minister of War and Marine on 6 April 1940, two Potez 63s were at the time equipped with two 7.9 mm machine guns, *collimateur* O.P.L. 31M, 65 mm gun camera C In-Tir type 65A, and still lacked the 20 mm HS 404 cannons. Since the French only delivered one flexible 7.9 mm Darne machine gun per aircraft, it is evident that the second (fixed) 7.9 mm machine gun installed must have been an M.38 (FN Browning), standard VV machine gun. It is interesting to note that Potez 63 was also listed in Yugoslav documents as a bomber aircraft with a bomb load of only 200 kg. In spite of this, both VV machines were used solely as fighters.

The original French documents lists the type as Potez 63, however VV used the official general designation Potez 63C-3, maintaining the French naming standard with the purpose and the number of crew. VV classified Potez 63 as „*двомоторни вишесед за вишеструку намену*” (twin engine multi-seat and multi-purpose aircraft) with two 670 mhp Hispano Suiza 14Ab 02/03 engines (at 3,800 m) or with two 660 mhp Gnôme et Rhône 14M 6/7 Mars engines (at 4,000 m). Yugoslav Potez 63 aircraft were equipped according to the French Air Ministry’s norm 2001/A, although VV machines differed from the French ones by having wider tires (800 x 270 mm instead of standard 800 x 200 mm), different onboard equipment, different gun sight and an option to carry external bomb load. Radio equipment consisted of *S.F.R. type 203* receiver-transmitter. Navigational instruments allowed the flight without external visibility. Oxygen equipment was Gourdou type and the suits were heated with warm air. Potez 630 had dual commands.

Both VV aircraft were assigned to 51.VG, the unit equipped with single-engine fighters. Aircraft participated in dislocation exercises to auxiliary airfields and aviation maneuvers. Pilots were not too fond of flying them because of their take off characteristics. At altitude their performance improved.

Potez 63 at April War

At the time of the German attack on 6 April 1941 both Potez fighters were unserviceable. Potez Br.2071 (№1Y, Br.1) was unserviceable and remained at Beograd Airport during the war. The second Potez, Br.2072 (№2Y, Br.2), was quickly repaired, and flew over to Veliki Radinci auxiliary war airfield in between the two German air attacks. During the return flight to Beograd Airport on 7 April at 11:00, the pilot, *kap Ik* Konstantin Antonov, stalled the aircraft from an altitude of 40-50 m while searching for a place to land and crashed on the runway. Both him and his crew member, *pnar* Branko Čupina, escaped without injury, while Br.2072 was damaged. This concluded the war time use of Potez 63s in the KJ as both were captured by the Germans soon thereafter, remaining at Beograd Airport the entire war time. In April 1944, during the Allied bombing of Belgrade, Br.2071 was damaged while Br.2072 was



The same scene and time, with pilot Leščenko posing in front of Br.2072 (Šime Oštrić via Ognjan Petrović)

As evident in this photograph Br.2072 remained in its final resting place even after the arrival of the Luftwaffe units to Beograd Airport. Note that the starboard wing carries the "Kosovo cross" insignia on the upper side, contrary of the standard practice. (Djordje Nikolić)



destroyed. The damaged Potez was discovered on 22 October 1944 during the liberation of Belgrade. According to the eye witness reports, it remained at Beograd Airport for another year or two after the war after which it was scrapped. Engineer Ljubiša Djordjević as a mechanical engineering student attended internship at Zemun and he recalls that in the beginning of the 1950s the fuselages of Bristol Blenheim and Potez 63 were still present there. Students called those remains which they were getting taught on „Bristol Blenheim class“ and „Potez 63 class“.

Camouflage and markings

Designation

General factory designation was Potez 63 C-3 (Potez Type 63 C.3), while two versions were designated as Potez 630 C-3 and Potez 631 C-3. In VV service both types were commonly known as Potez 63 (as written on the rudder) or more detailed, Potez 630 C3 and Potez 631 C3.

Serial numbers

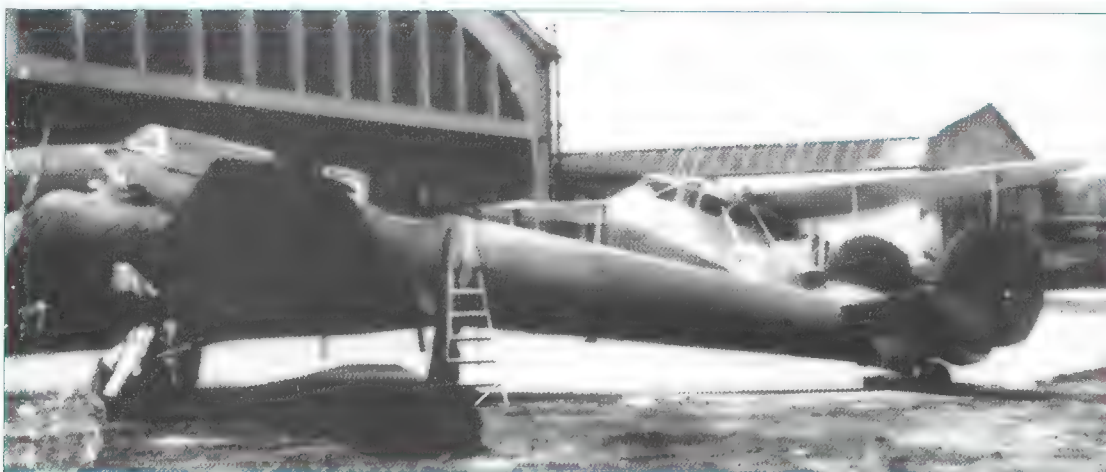
Potez 630 and Potez 631 were delivered with factory applied c/nos №1Y and №2Y respectively. Originally VV serials №1 (Br.1) and №2 (Br.2) were changed in 1940 to EvBr 2071 and 2072 and were applied to the outer rudder sides, directly over the camouflage, in the form of Black numbers 2071 and 2072.

Front view of Potez 630 C-3 Br.2071 along with other captured VV aircraft at Beograd Airport. Note that this Hispano-Suiza equipped machine (recognizable by the air intakes on the upper side of the engine cowlings) was camouflage painted when it entered the 1941 April War. (Jan van den Heuvel)





Br.2071 was unserviceable prior to April War and it remained grounded during the entire conflict. It was captured at Beograd Airport. Camouflage patches are visible despite the poor quality of the photo. Note the black s/n on the vertical stabilizer and the "Kosovo cross" on the upper side of the port wing. (Boris Ciglić)



Captured Potez 630 C-3 Br.2071 (ex №1) in front of one of the hangars at Beograd Airport. In the background is DH Dragon Rapide belonging to the Aeponym (Aeropot Airlines), Yugoslav flag-carrier. The photo was taken in the late spring of 1941. (Aviation Museum – Belgrade)

Camouflage

Both Potez 63 aircraft were delivered in overall natural Aluminum with only the Black code letters applied on the fuselage.

Later in 1940, both VV machines were painted in the newly introduced three colour-camouflage scheme with Dark Green, Dark Brown and Ochre on the top and Light Blue Grey on the bottom. As Potez 63 had similar dimension and form of wing plan, VV adopted the similar camouflage patches as were on Yugoslav Dornier Do-17K bombers.

Starboard wing of Potez 631 2072, which is lying on its belly clearly shows "Kosovo cross" on the upper side.

Camouflage patches are also visible. Note the damaged Spartan Cruiser YU-SAN without undercarriage legs in the background. (Jan van den Heuvel)

Registrations

Potez 630 №1Y arrived in the country with French civil registration F-AREY applied on four positions in Black. The registrations on the wings were split, with F-A applied on the port and the remaining three letters on starboard side. Black letter F was set on vertical tails, while rudders were free from any markings.

Markings and inscriptions

After the arrival of Potez 630, Yugoslav state flags were applied over both sides of both rudders with VV Black titles in three rows (Potez 63 №1) while letters F on tail were removed.

The national markings, "Kosovo cross" insignias, were applied on Potez 630 Br.1 (later 2071) in four wing posi-



tions. Potez 63 Br.2071 had standard VV asymmetrical insignias applied on the top of the port wing and bottom of the starboard wing at the time the machine was camouflage painted.

The second machine, Potez 631 Br.2072 carried asymmetrical insignias as well, but contrary to the regulators, applied on the top of starboard wing and bottom of the same wing. Interestingly, both “Kosovo crosses” had the same 100 cm diameter.

Standard VV tail stripes (the so-called “war flags”) were not applied to these machines.

| VV designation | Original № | c/n | VV № | EvBr | Note |
|----------------|------------|------|------|------|--|
| Potez 630 C-3 | №1Y | 4530 | №1 | 2071 | With dual controls |
| Potez 631 C-3 | №2Y | 4971 | №2 | 2072 | Standard P.631 C3 with different onboard equipment |

| Aircraft Characteristics Potez 63 (Potez 630 C-3) | |
|---|---|
| Quantity used: | One |
| Crew: | 3 |
| Years of Service: | 1939-1941 |
| Span: | 16.0 m (52.5 ft) |
| Length: | 11.1 m (36.3 ft) |
| Height: | 3.6 m (11.9 ft) |
| Wing area: | 32.7 m ² (352 ft ²) |
| Engine: | Two 670 mhp (660 hp) Hispano Suiza 14Ab 02/03 |
| Empty weight:* | 2,450 kg (5,402 lb) |
| Loaded weight:* | 3,850 kg (8,489 lb) |
| Maximum speed: | 460 km/h (286 mph) at 5,000 m (16,404 ft) |
| Rate of climb: | 9.2 m/s (30.18 ft/s) |
| Service ceiling: | 6,000 m (19,686 ft) |
| Range: | 1,220 km (758 ml) |
| Armament: | One flexible 7.9 mm Darne (Darne A.T.D type “tourelle”) machine gun facing rearwards and one fixed 7,9 mm M.38 (FN Browning) machine gun facing forward |

* Interestingly, different weight values for Hispano Suiza powered Potez 63 C3 were given in *Vazduhoplovni glasnik* No9/1938 and No3/1939: empty weight 2,814 kg (6,205 lb), loaded weight 4,066 kg (8,966 lb) and maximum allowed weight 4,400 kg (9,702 lb). Fuel weight was 660 kg (1,455 lb), while payload of 592 kg (1,305 lb) consisted of crew 261 kg (575 lb), weapons and ammo 237 kg (523 lb), radio equipment and other 94 kg (207 lb).

| Aircraft Characteristics Potez 63 (Potez 631 C-3, nicknamed Potez-K) | |
|--|---|
| Quantity used: | One |
| Crew: | 3 |
| Years of Service: | 1940-1941 |
| Span: | 16.0 m (52.5 ft) |
| Length: | 11.1 m (36.3 ft) |
| Height: | 3.6 m (11.9 ft) |
| Wing area: | 32.7 m ² (352 ft ²) |
| Engine: | Two 660 mhp (651 hp) Gnôme et Rhône 14M 6/7 Mars |
| Empty weight:* | 2,450 kg (5,402 lb) |
| Loaded weight:* | 3,760 kg (8,291 lb) |
| Maximum speed: | 442 km/h (275 mph) at 4,500 m (14,764 ft) |
| Rate of climb: | 9.2 m/s (30.2 ft/s) |
| Service ceiling: | 6,000 m (19,686 ft) |
| Range: | 1,220 km (758 ml) |
| Armament: | One flexible 7.9 mm Darne (Darne A.T.D type “tourelle”) machine gun facing rearwards and one fixed 7,9 mm M.38 (FN Browning) machine gun facing forward |

* The same monthly reviews gave also different weights for Gnome-Rhone equipped Potez 63 C3: empty weight 2,664 kg (5,874 lb), loaded weight 3,916 kg (8,635 lb) and maximum allowed weight 4,400 kg (9,702 lb). Fuel weight and payload were the same as the values of P.630.

Potez 63 (Potez 630) №1 F-AREY, newly delivered machine, Beograd Airport, early 1939.

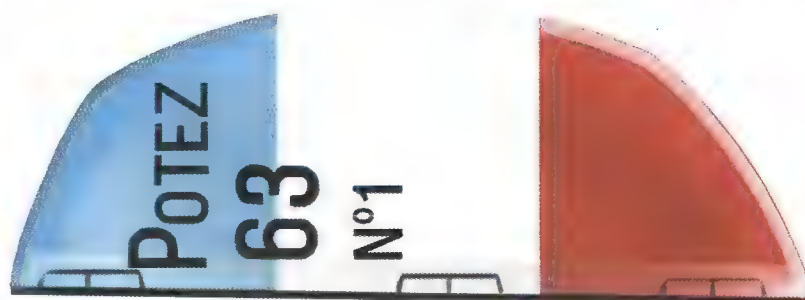


Artwork by
№975/19
Ognjan M. PETROVIĆ

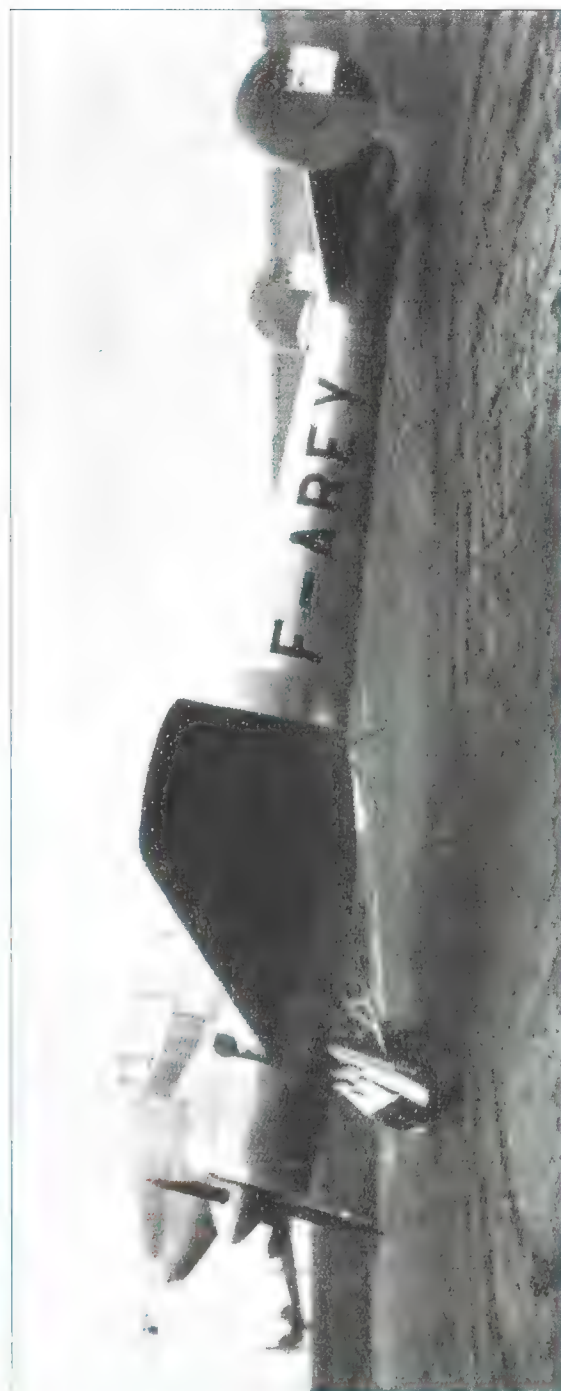
Logos from 1936 of Avions
Potez and Hispano Suiza.



№1 F-AREY with dual markings – French registrations still remained while the
Yugoslav flags on both sides of both rudders and VV tail inscriptions (POTÉZ 63
№1) were just applied. (Michel Ledet)



Nonstandard rudder inscrip-
tions, only aircraft type and s/n
without aircraft weights.





Artwork by
**№976/19
Ognjan M. PETROVIĆ**

2072

Enlarged s/n 2072.

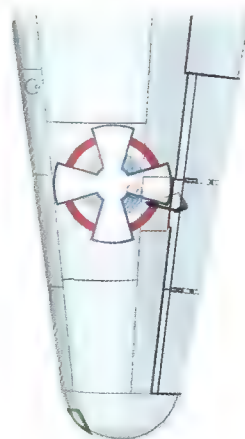
Potez 631 C-3 Br. 2072 (ex №2) crash landed and was damaged at 11:00 on 7 April 1941 when its pilot stalled the aircraft from an altitude of 40 to 50 m. The machine was painted in a three tone camouflage with Dark Green, Dark Brown and Ochre on top and Light Blue Grey below. Note the absence of radio mast. (Ruy Alexandre Aballe Vieira via Boris Ciglić)



Upper view of 2072 shows VV three-tone camouflage scheme with Dark Green, Dark Brown and Ochre on top and Light Blue Grey below. The scheme was introduced in 1939 and standardized for newly delivered fighter and bomber types such as Hawker Hurricane, Ikarus IK-2, Rogožarski IK-3, Bristol Blenheim, Dornier Do-17 and Potez 63.

National insignias, 100 cm diameter "Kosovo crosses", were applied on the upper side of the starboard wing (opposite of the official VV manner) and on the lower side of also starboard wing (according to the VV manner). Tail stripes (state flag) were not used on camouflaged Potez 63 fighters.

Artwork by
Ognjan M. PETROVIĆ
№977/19



Partial view of starboard wing lower surface.



Logo of Société des Moteurs Gnôme et Rhône



Logo of Société Anonyme des
Aéroplanes H. Potez

Rogožarski R-313

Background

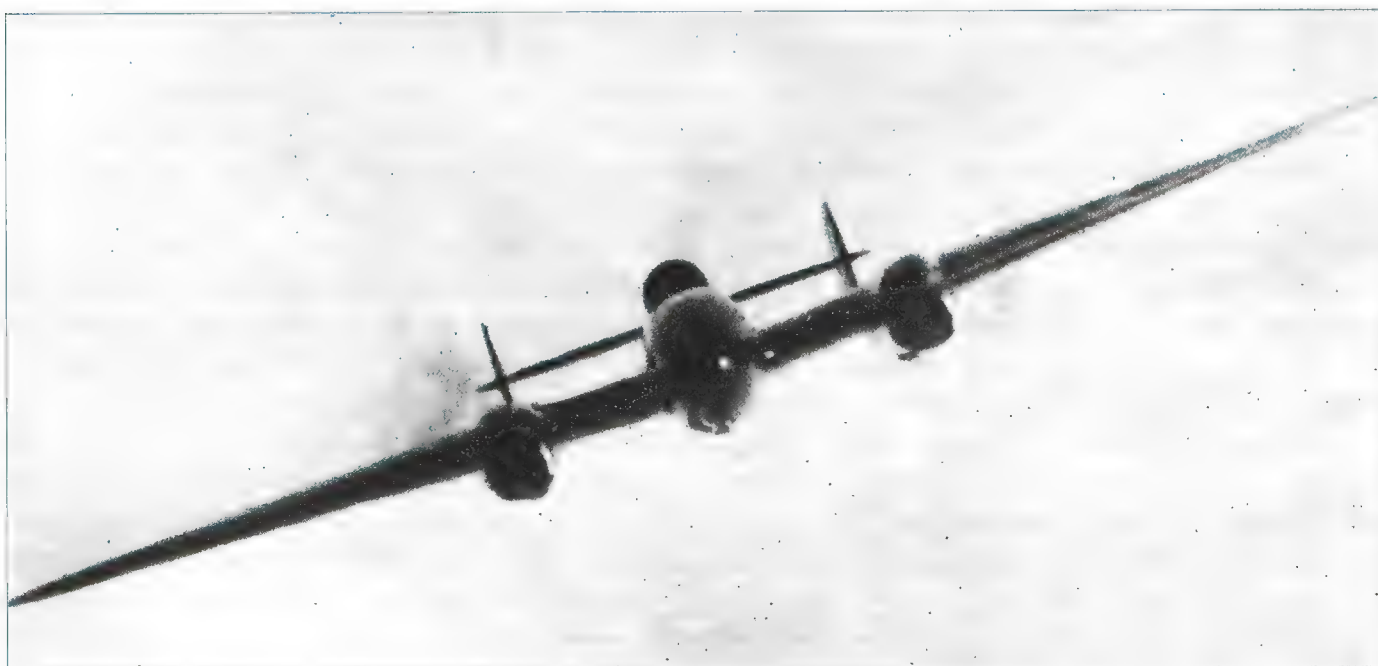
Rogožarski R-313, a twin engine reconnaissance fighter and light bomber aircraft, was without a doubt, in all meaning, the best design created by engineer Sima L. Milutinović and one of the best Yugoslav concepts prior to World War II. Project was officially classified as „двомоторни ратни авион за вишеструку употребу мање тонаже” (light weight twin engine multi-purpose aircraft) and „двомоторни аероплан модерне концепције и мање тонаже, а са довољно великом брзином која има бити постигнута са релативно слабијим моторима” (light weight twin engine modern aircraft with sufficiently high speed which must be attained with less powerful engines). With clean aerodynamic lines and modern wooden construction, the R-313 exhibited fighter like maneuverability and was in speed, rate of climb and take off distance approaching the performance of modern fighter aircraft of the time, having exceeded the performance of foreign destroyer types. All in all it was a reputable aircraft, in spite using the low power engines. It was the last design to join the VV Headquarters' competition for twin engine multi-purpose aircraft, as Ikarus and Zmaj factories at the time have already advanced in their work on Orkan and R-1 bi-motors respectively.

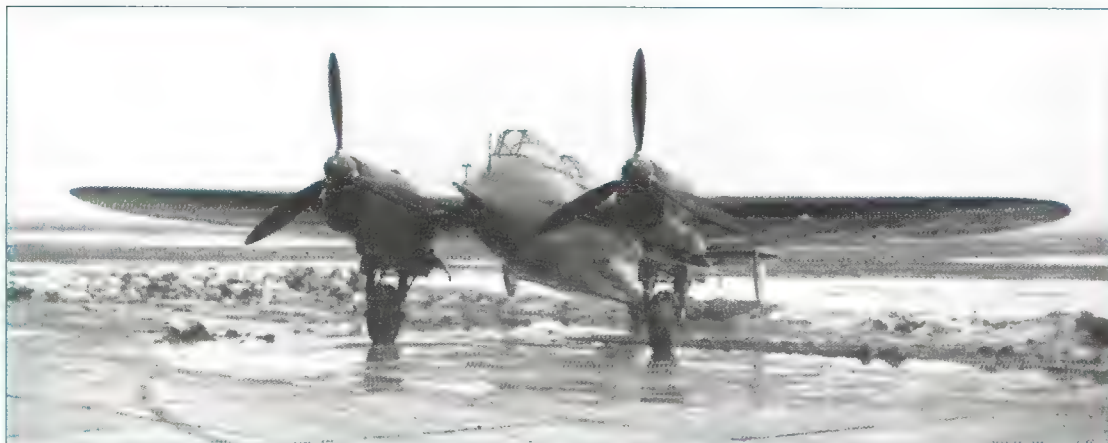
Prototype design

Head on view of the Rogožarski R-313 wind tunnel model, which was sent to Warsaw for testing. (1939 Yugoslav Aviation Yearbook)

At the very beginning of the project, the aircraft was assigned a designation SIM XV, which naturally followed the numeration of the last completed floatplane project, SIM XIV, by the same designer. In spite of this early designation, the VV Headquarters requested that the name be changed to one which was coded for security reasons, hence the aircraft was re-designated R-313.

Engineer Milutinović, one of the most successful Serbian aircraft creators, technical manager and chief designer of Rogožarski A.D. factory, had the intent to create a light weight aircraft, with less pow-





This photo was most likely taken in the early 1940 as evident by the snow still on the ground. Completed prototype was used for center of gravity measurements on 24 February 1940 and it is believed that the first flight took place by the end of March. (1941 Yugoslav Aviation Yearbook)

erful engines which would make it very economical to manufacture and exploit, while at the same time ensuring that its performance met the requirements. At first, he evaluated the total load the aircraft was required to carry while taking special care about the weight to load ratio. Thereafter, he selected the materials of construction based on what the domestic industry was able to manufacture by utilizing processes mastered at economical cost, hence wood was selected for all of the main sub-assemblies. The basic design was completed in August 1937 with the oval cross-section fuselage, trapezoidal wings and twin vertical stabilizer design.

To power the aircraft, the designer selected two twelve-cylinder inverted-Vee air-cooled Walter „Sagitta” II-R piston engines, geared and supercharged, rated nominally 550 mhp at 3,800 m at 2,500 rpm and 600 mhp at 2,600 rpm for take-off. These engines had a very narrow frontal surface area which helped reduce drag. The calculations showed that with this engine, the aircraft would be able to attain a maximum speed of 448 km/h at 5,000 m. It is interesting to note that engineer Milutinović also analyzed the performance of R-313 with an alternative engine option, using Hispano Suiza 14Ab, rated nominally at 680 mhp. These French-built engines were at the time intended for installation in the competitor aircraft, the Orkan and R-1.

Between 11 to 30 September 1937 a wooden model created at the Rogožarski A.D. workshop was tested in Warsaw wind tunnel. The favorable testing results further confirmed the soundness of the design. It is interesting to note that this model survives to this date and is on display at *Музеј ваздухопловства – Београд* (Belgrade Aviation Museum).

The R-313 was occupied by two members, pilot whose cockpit was located ahead of the wing and the observer/gunner whose cockpit was located mid-fuselage. In the reconnaissance version, the aircraft was to be equipped with a camera and a radio station while retaining the same weapons of fighter version, one 20 mm cannon with 60 rounds in the nose as offensive armament and one 7.9 mm machine gun with 500 rounds for defense in the upper rear hemisphere. In the bomber version, in addition to the armament discussed above, the R-313 could carry a total of four indigenous-designed VISTAD-built 106 kg Stanković bombs stored in a fuselage bomb bay. The machine was equipped with Sperry gyro-horizon and oxygen devices. Predicted communication and navigation equipment was to include Telefunken products such as 274 I/F receiver-transmitter, 128-N direction finder and P-63 uN (VV des. P-63 iN) radio compass. Two Nistri O.M.I and two Löschner type cameras were also predicted.

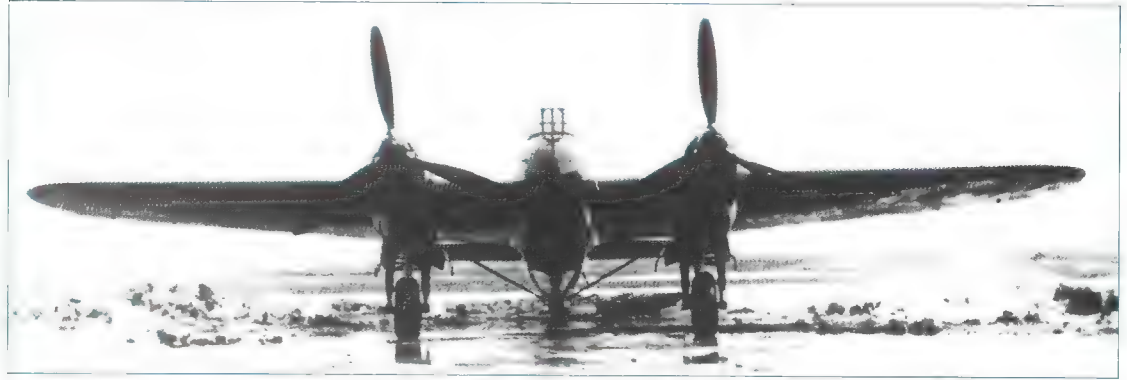
Prototype construction

The contract for the construction of a single prototype worth a total of 3,790,265 D was signed on 3 May 1938. As technical documentation was almost complete, the construction of various sub-assemblies commenced at once. The last of the drawings were finalized during 1939 as the construction progressed. All the wooden sub-assemblies were manufactured at Rogožarski A.D. while more complex equipment such as hydraulic, electrical, fuel and oil installations were ordered from abroad. To simplify the installation of this equipment, a partial fuselage and wing mock up was constructed to aid in the location and fit check which would avoid any unnecessary changes taking place on the prototype under construction.

Flight testing

At the very end of the assembly on 24 February 1940, the R-313 was partially fueled and was taken for center of gravity measurement. Although the exact date remains unknown, it is assumed that the

Rogožarski R-313, due to its similarity to German Messerschmitt Bf 110, caused an alarm with the crews of Independent 81.VG at Mostar on 6 April 1941 following the German attack against KJ. (Rogožarski factory via Šime Oštrić)



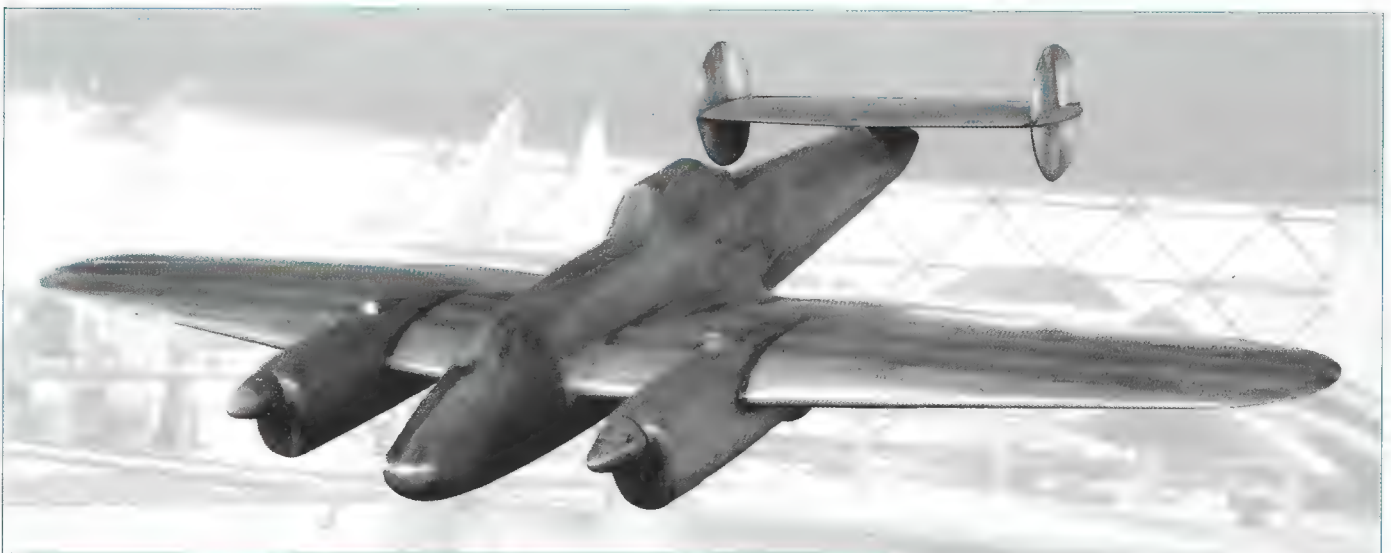
first flight took place not long thereafter, most likely at the end of March or in early April. Pilot *kap Ik* Milan V. Bjelanović, who already conducted test flights with the single engine Rogožarski IK-3 fighter, was selected for the first test flight. To everyone's content, flight testing progressed without encountering any major problems. As a result, the aircraft was ready for hand off to VOG, whose experts determined that the aircraft had exception stability and that in some aspects handled like a fighter.

Testing confirmed that the maximum ground speed is 370 km/h and astonishing 448 km/h at 5,000 m. With a rate of climb of around 9 m/s to 5,000 m, the design further proved its parity with the performance of modern fighter aircraft. Take off distance was also exceptionally short, which at full loaded weight (in fighter version) was only 270 m. To further prove the trust in the design, an official report by the VV Headquarters dated 15 July 1940 indicated that if the R-313 testing concludes successfully, an order for a total of 25 aircraft would follow. These aircraft would join the 51.VG by spring of 1941. In spite of these promises, the contract was not signed before the April War. This did not discourage the factory who began acquiring the necessary equipment and materials in anticipation of the order.

1941 April War

Immediately prior to the war, R-313 was still assigned to VOG, but was re-assigned to the 603.TE (*тренажна ескадрила* – Training Escadrille) which performed multi-engine aircraft conversion training and typically flew the Italian Caproni Ca-310bis twin engine aircraft. The 603.TE relocated from Beograd to Mostar and not long thereafter to Grab wartime auxiliary airfield. The R-313 conducted several flights from this location. Due to the similarity with German Messerschmitt Bf 110 destroyers, on 6 April crews of the locally based Independent 81.VG even raised an alarm when they saw the R-313 on approach to their airfield. On April 12 the R-313 made another flight from Grab to Mostar and the next day it crash landed at Grab ending its service within the VV. The pilot was *maj* Milivoje M. Mišović, Commander of Multi-Engine Conversion School, who failed to notice a ditch in his path. Following the end of the hostilities, R-313 was captured and in May 1941 it was transported to Beograd Airport. The aircraft was repaired at Ikarus factory which was at the time working for German WNF (*Wiener-Neustädter Flugzeugwerke*). Germans finally handed it off to Croats where it was named "Nezavisni" (Independent). Its new owners never used as it crash landed on its first test flight on 19 May 1942 due to a deliberate act of sabotage.

Original wooden Rogožarski wind tunnel model is today preserved in the collection of the Aviation Museum in Belgrade. (Ognjan Petrović)



Post World War II development

In accordance with the required specifications within the competition issued by the Yugoslav Army Aviation in 1946, engineer Sima Milutinović designed a twin engine training aircraft of wooden construction based on the preserved R-313 testing documents. The aircraft, designated as Type 214, was manufactured by Ikarus. In total 23 were produced including 214P and 214D prototypes, three 214F photo reconnaissance/transport and 18 214AS (214P) airliner/transport/reconnaissance/transition trainers. These aircraft served within JRV (*Југословенско ратно ваздухопловство* – *Yugoslav Air Force*) and VSJ (*Ваздухопловни савез Југославије* – *Aeronautical Union of Yugoslavia*) during the late 1950s and 1960s.

Camouflage and markings

Type Designation

The type was originally designated as SIM XV (or Sim XV) by the designer. Designation R-313 applied by the Technical Department within VV HQ was officially adopted by the factory and VV.

Numbers

As the first (and sole) exemplar of the type, R-313 obviously was c/n 1. As the machine was in testing at VOG until 1941 April War, s/n was not applied by VV.

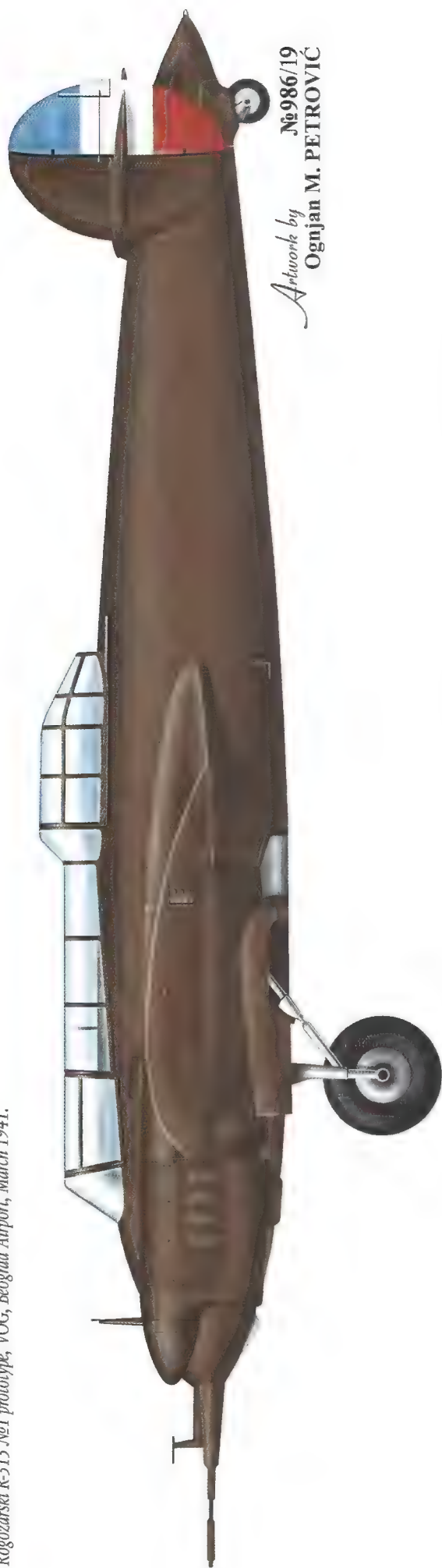
Camouflage scheme

The R-313 prototype was painted overall in Dark Brown colour paint of French origin, which most closely resembled that of Chestnut or Dark Chocolate. This painting scheme was unique in VV.

Markings

National markings consisted only of a state flag (top to bottom, Blue/White/Red) which was factory painted over the entire surfaces of both rudders, on both sides. Upon arrival to VOG, it most likely received the required VV markings on the wings placed asymmetrically on the top of left wing and below the right wing. To date, no photographs of R-313 with “Kosovo cross” have been discovered, since they were applied shortly before the war, perhaps even as late as 6 April 1941. The R-313 lacked any service inscriptions.

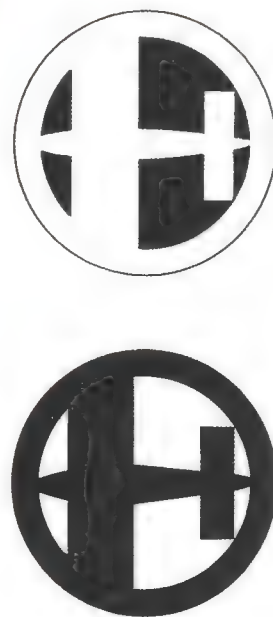
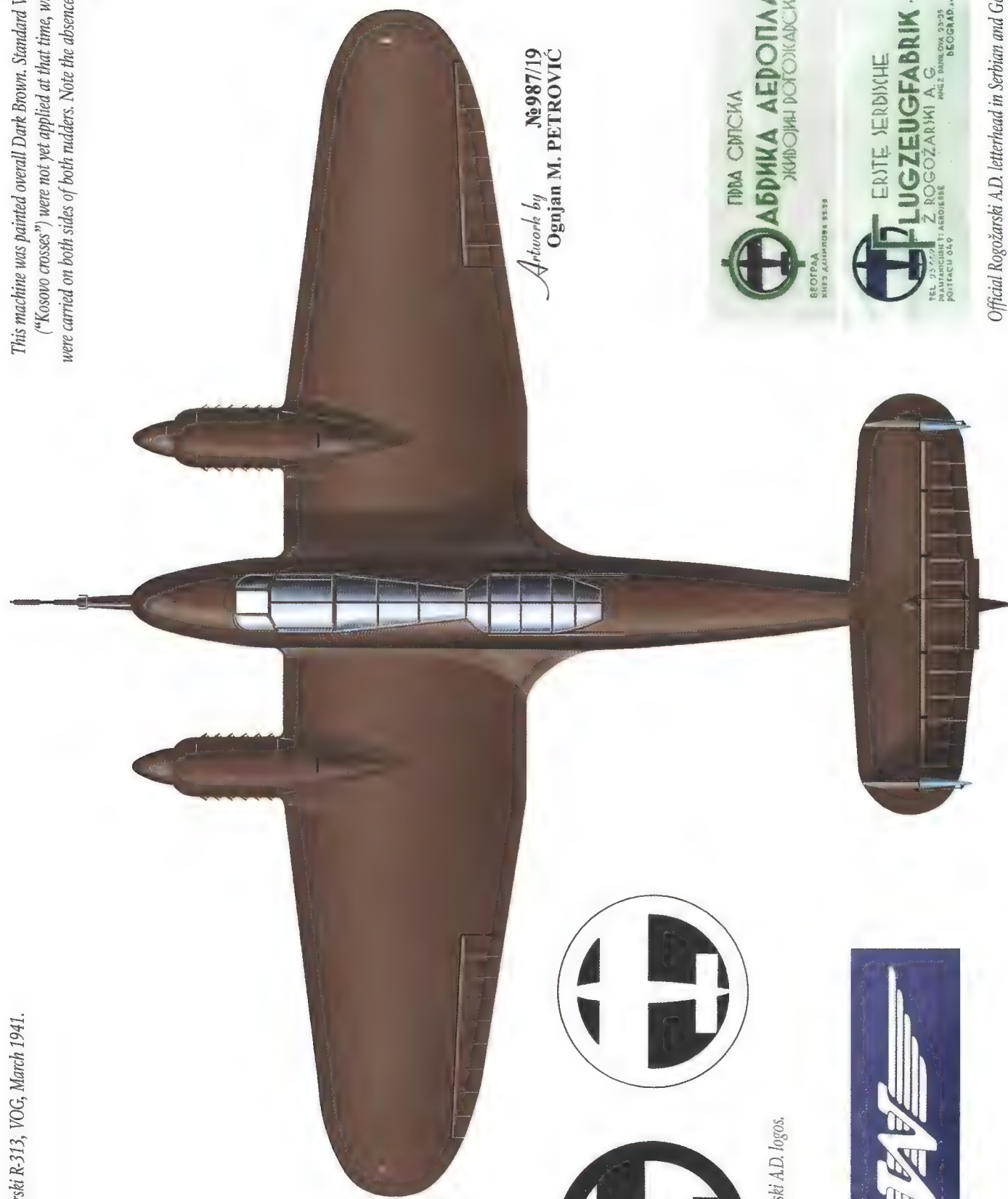
| Aircraft characteristics Rogožarski R-313 | |
|---|--|
| Quantity used: | 1 |
| Crew: | 2 |
| Years of Service: | 1940–1941 |
| Span: | 13.0 m (42.6 ft) |
| Length: | 11.0 m (36.1 ft) |
| Height: | 2.7 m (8.8 ft) |
| Wing area: | 26.4 m ² (284 ft ²) |
| Engine: | Two 550 mhp (542.5 hp) Walter „Sagitta” II-R |
| Empty weight: | 2,900 kg (6,393 lb) |
| Loaded weight: | (reconnaissance and fighter) 3,820 kg (8,422 lb) (light bomber) 4,270 kg (9,414 lb) |
| Maximum speed: | 448 km/h (278 mph) at 5,000 m (16,405 ft) |
| Service ceiling: | 8,000 m (26,247 ft) |
| Climb to 5,000 m: | 9 min 12 sec |
| Endurance: | 2 h 9 min |
| Armament: | One fixed 20 mm M.39 (Oerlikon FF) cannon, one flexible 7.9 mm M.38 (FN Browning) machine gun, 400 kg bombs (light bomber) |



Side view of R-313 showing the dual seat cockpit configuration with two sliding canopies. Note the 20 mm Oerlikon FF cannon in the nose and no defensive armament installed at the time. The rudders were painted in the colour of the national state flag with Blue/White/Red. (Aviation Museum – Belgrade)



This machine was painted overall Dark Brown. Standard VV national insignia ("Kosovo crosses") were not yet applied at that time, while large state flags were carried on both sides of both rudders. Note the absence of any inscriptions and service stencils.



Two styles of Rogožarski A.D. logos.



Walter a.s. logo.

Artwork by
№987/19
Ognjan M. PETROVIĆ



Official Rogožarski A.D. letterhead in Serbian and German language.

Zmaj R-1

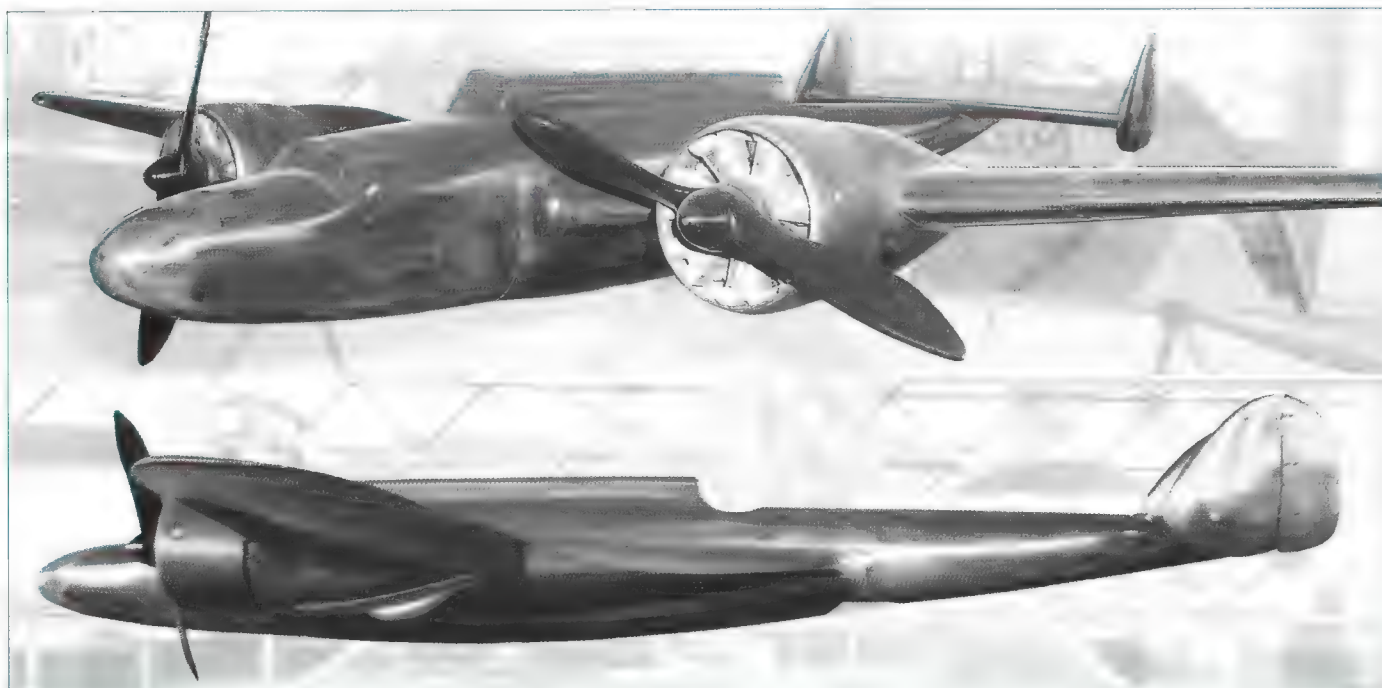
Background

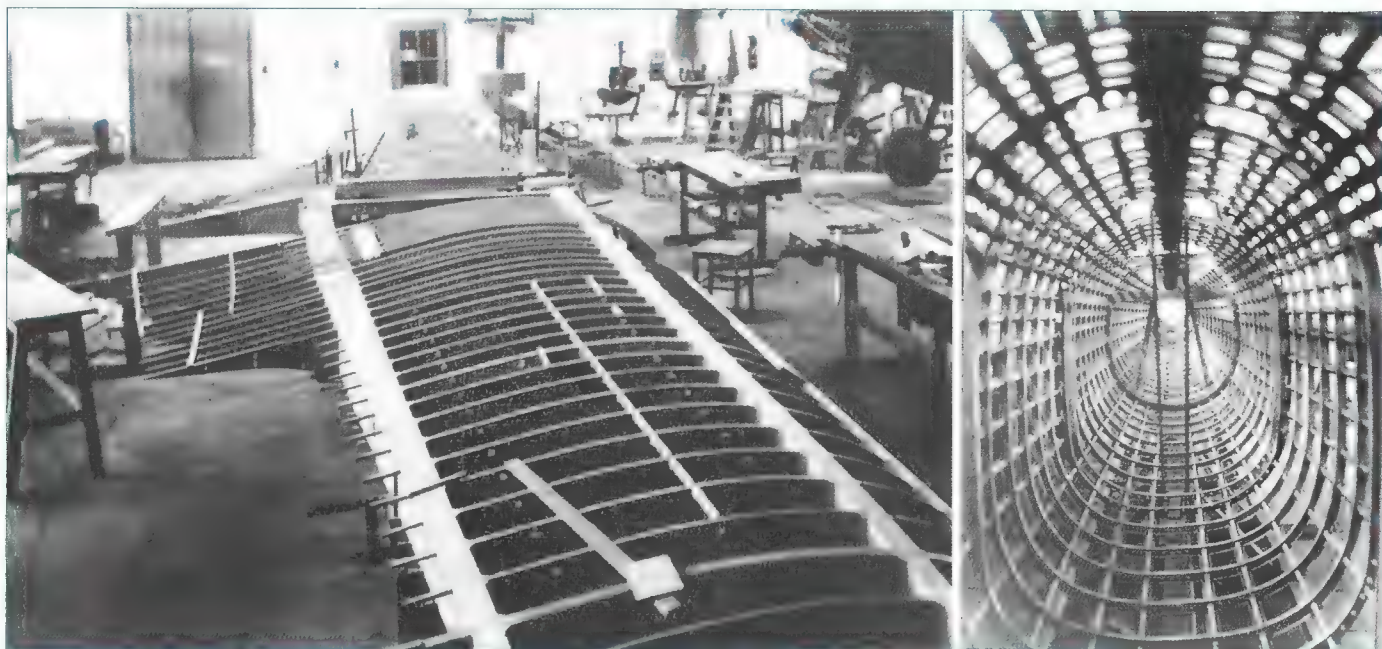
Zmaj R-1 was one of the most advanced and most modern types of Yugoslav aircraft in the period before World War II. With immaculate aerodynamic lines, modern mixed construction and skillfully selected armament and loading, it represented a typical multi-purpose aircraft. The prototype has met its creator's expectations in full as was validated during short test phase it was subjected to.

Successful Serbian aeronautical engineer Dušan S. Stankov, a specialist for static and aerodynamic calculations who was technical director of Zmaj (Dragon) factory (Фабрика Аеро и Хидроавиона „Змај“ Петровић и Штјерпић А. Д. – Aircraft and Hydroplane Factory „Zmaj“ Petrović i Šterić A. D.) since April 1 1933, paid a visit on official business to the *le XIV^{ème} Salon de l'Aéronautique* in Paris in the second half of November 1934. During his visit, he made contact with and had conversations with representatives of numerous aircraft factories and design bureaus. Following his return, he proposed to the VV Headquarters that, together with a group of recognized domestic designers, a project be commenced to create a modern twin engine bomber which would meet the Air Force's need for rearming and modernization of bomber units. Since the VV Headquarters accepted the proposal, engineers Stankov, Rudolf M. Fizir, Sima L. Milutinović and Djordje T. Ducić signed a special contract on 14 July 1935 which instructed them to work together, privately and with partial support from Zmaj design bureau on developing a twin engine bomber. The prototype itself was intended to be constructed by the Zmaj factory.

Due to work on own projects, Milutinović, Fizir and Ducić did not have the time to contribute much to this project, so engineer Stankov had to rely on support from Zmaj bureau to complete preliminary project which was according to the factory documents named B.V.Z (most likely *Бомбардерско-Ваздухопловни Змај* or Bomber Aeronautical Zmaj). The calculations by engineer Stankov were validated during testing in a wind tunnel, most likely in Poland and the preliminary drawings were handed over to the Headquarters in mid 1936. According to the preserved photographs of the model, B.V.Z. was

Original 1:10 scale wooden model which was made for testing in Warsaw's wind tunnel is now displayed at the Aviation Museum at Belgrade Nikola Tesla Airport, BEG/LYBE. (Ognjan Petrović)





a twin engine mid wing aircraft with retractable landing gear, blunt nose and one vertical stabilizer. Conceptually it was similar to the Soviet Tupolev SB-2 bomber and Italian FIAT BR-20 and some other aircraft types which were at the time undergoing trials. With the opinion that engineer Stankov was late to propose his idea as such aircraft already existed, VV HQ did not accept the preliminary design, however it continued to support work on twin engine domestic bomber aircraft.

With the intent to return some of the investment put into the B.V.Z. design, Zmaj factory made an offer to the national air transport company Aeroput, that a fast passenger plane be developed on the basis of the B.V.Z. Aeroput Airlines did not accept this offer since it was at a time negotiating the purchase of French Caudron C.449 Goeland aircraft. In spite of these setbacks, while anticipating the future needs by the VV, engineer Stankov proposed in 1936 that Zmaj factory constructs one new twin engine multi-purpose aircraft which would have the characteristics of a fighter, light bomber and reconnaissance aircraft. The owners of Zmaj, engineer Jovan T. Petrović and Dragoljub T. Šterić accepted this proposal. Such aircraft, so called destroyer (Germans called them *Zerstörer*), were highly regarded by many aeronautical experts at the time and some of the developed countries already announced their manufacture and introduction in service. All this resulted in engineer Stankov gaining a permission to construct a prototype at factory's expense.

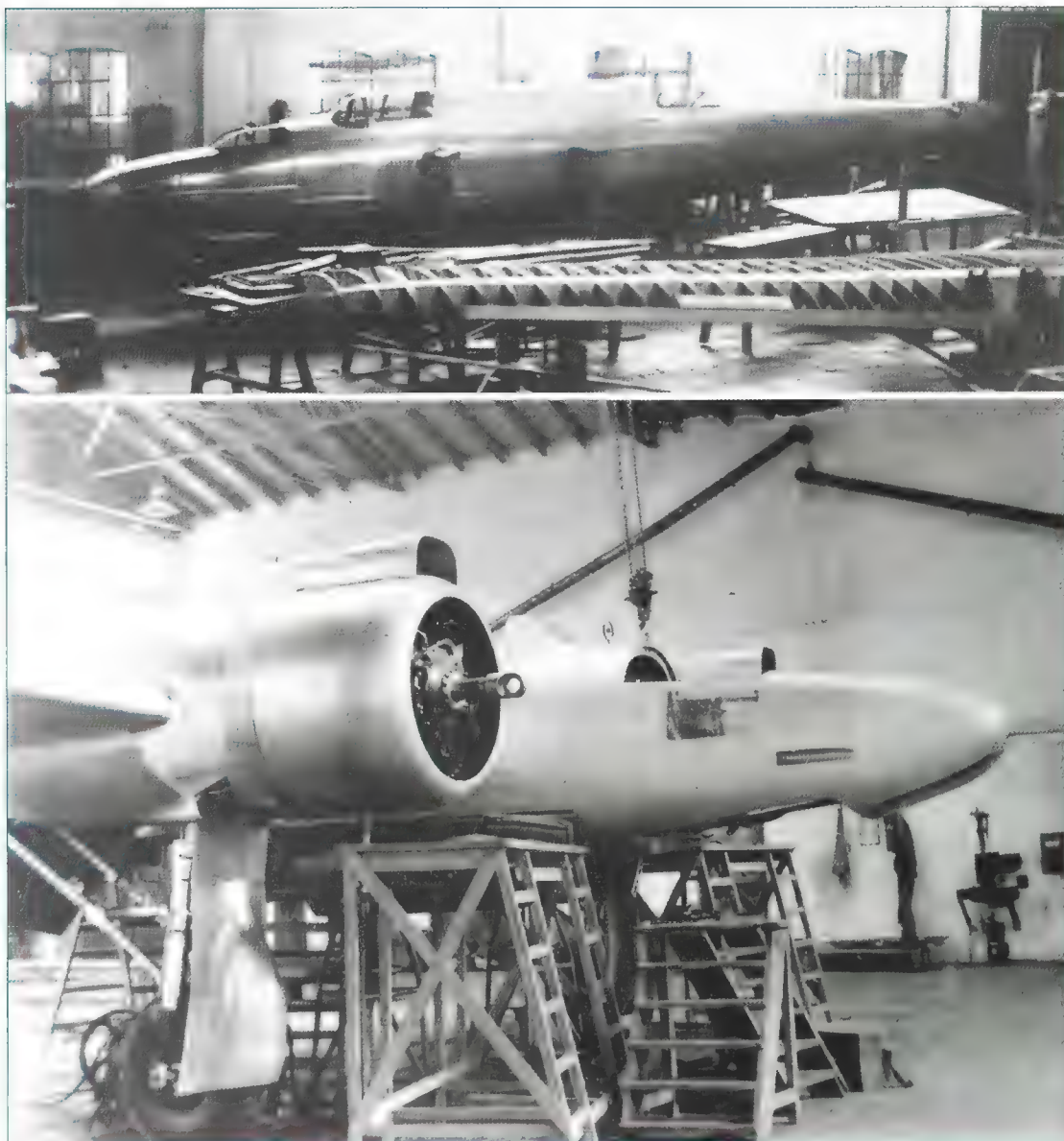
Manufacturing process at Zmaj A.D: (left) wing spars and ribs; (right) look at the interior of the fuselage structure. (both Aviation Museum – Belgrade)

Prototype design

From the beginning, it was engineer Stankov's intent that the prototype achieves high speed. With this in mind, he took efforts to ensure maximal aerodynamic efficiency of all aircraft components and joints. He selected the mid wing concept with elongated spindle type fuselage and large wing fuselage fairings. For design reasons, main landing gear wheels in retracted position were protruding just slightly outside of the engine nacelles and were protected with specially designed fairings. To enable a better field of view for the rear gunner, twin vertical stabilizers were selected. To power the aircraft, engineer Stankov selected at the time a modern 14-cylinder two-row air-cooled French Hispano Suiza 14Ab 00, geared and supercharged radials, rated at 680 mhp with 2,400 rpm at 3,800 m. These engines had very small cross section, which significantly reduced drag. Hispano Suiza designated these engines as Type 80, and the development of the entire family of these engines was based on the license purchased from the American Wright company. It is interesting to note that engineer Stankov was the first one in the Kingdom of Yugoslavia to select the 14Mb engines, which were later proposed on another domestic aircraft type, Orkan, and used on one purchased from France, Potez 63.

To verify the calculations, Zmaj constructed a 1:10 scale model at the end of 1936. This model was sent to the wind tunnel at the *Instytut Badań Technicznych Lotnictwa* (Institute of Aviation Technical Research) in Warsaw, which at the time was one of the best in Europe. Following the aerodynamic testing at different angles of attack, the testing was expanded to include static loading of main construction elements, which significantly simplified the selection of most efficient solutions at the latter stages of the project. During the testing of the model, the experts at Warsaw institute suggested to engineer Stankov to make changes to the wing profile, which he accepted by having selected their profile №811

The construction of the prototype started at the beginning of 1939 and it was completed at the beginning of January 1940 at Zmaj hangar in Zemun (top Aviation Museum – Belgrade, bottom Šime Oštrić via Ognjan Petrović)



successfully improving the performance. At the same time, the fairings between the wings and the fuselage was changed.

Based on the test results the preliminary aircraft performance was established and as a result Zmaj factory made an offer to the VV HQ on 1 February 1937 for one prototype to be built. The aircraft, named „Змајев разараач број 1” (Zmaj destroyer number 1), was assigned officially a designation R-1 by the VV HQ. The type was classified as “Zmaj R-1, aircraft for combat (destroyer), bombing and reconnaissance (a multi purpose aircraft)”. In accordance with the offer, the new aircraft was a twin engine destroyer with three seats, with the armament which included two cannons and two machine guns facing forwards and one twin machine gun facing rearwards. Bomb gun-sight was installed in the front cockpit and weapons gun-sight ahead of the mid cockpit. The plane was intended to have a bomb load of 400 kg and to have provisions for photo reconnaissance and radio equipment. The calculations indicated a maximum speed of 475 km/h at 4,300 m and the climb time of 1 minute and 39 seconds to 1,000 m. These figures were comparable to the best fighter aircraft of the time.

In spite of promising design, VV HQ delayed the final decision to construct the prototype, since a decision was made in mid 1937 to organize an informal competition for a twin engine bomber-destroyer. The intent of the HQ was to incite competition amongst the designers which would result in a creation of a better aircraft. Another two design groups joined the competition, one which was part of Ikarus factory working on Orkan project, and the other which was part of Rogožarski factory which was working on R-313. Both of those projects were handed over to the VV HQ at the end of 1937, and following the comparison of submitted information it was determined that all aircraft in the competition were of similar performance. As a result, at the beginning of 1938 a decision was made to order three prototypes and to make a decision which of them will enter series production only following the successful conclusion of flight testing.



Zmaj signed a contract VMT Br. 495 with VV HQ on 28 March 1938 worth a total of 5,368,446 D which obliged it to construct a prototype of Zmaj R-1. This sum included the purchase of two engines, two cannons and expenses to construct a model for testing in the wind tunnel. The contract also listed that a total of 42,000 man hours shall be spent to construct the prototype. During the First International Aviation Exhibit in Belgrade, which took place from 28 May until 13 June 1938, a model of Zmaj R-1 was placed on display (along with models of competition aircraft R-313 and Orkan). Not long before, a famous aeronautical magazine *Воздухопловни гласник* (Aviation Herald) in 5/1938 edition published an extensive article about three twin engine prototypes listing in detail their performance.

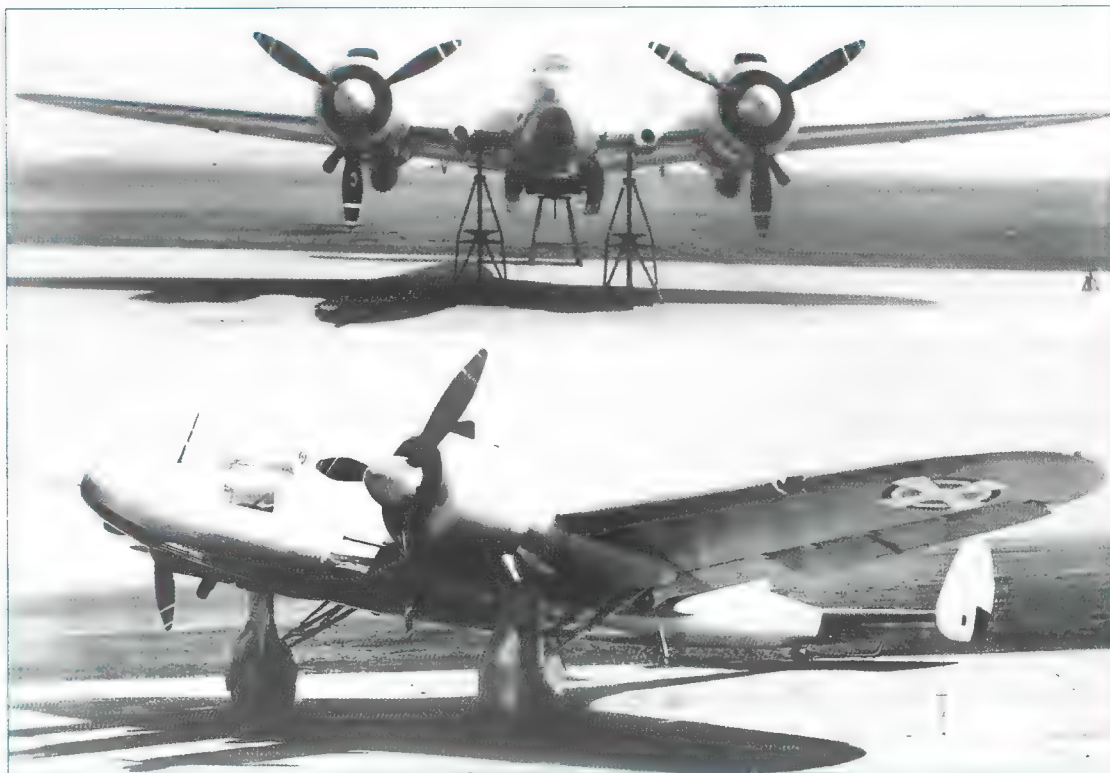
Completed Zmaj R-1 with propellers and canopy installed. The aircraft is about to undergo landing gear and electrical systems check prior to disassembly and transfer to Beograd Airport. (Aviation Museum – Belgrade)

Prototype construction

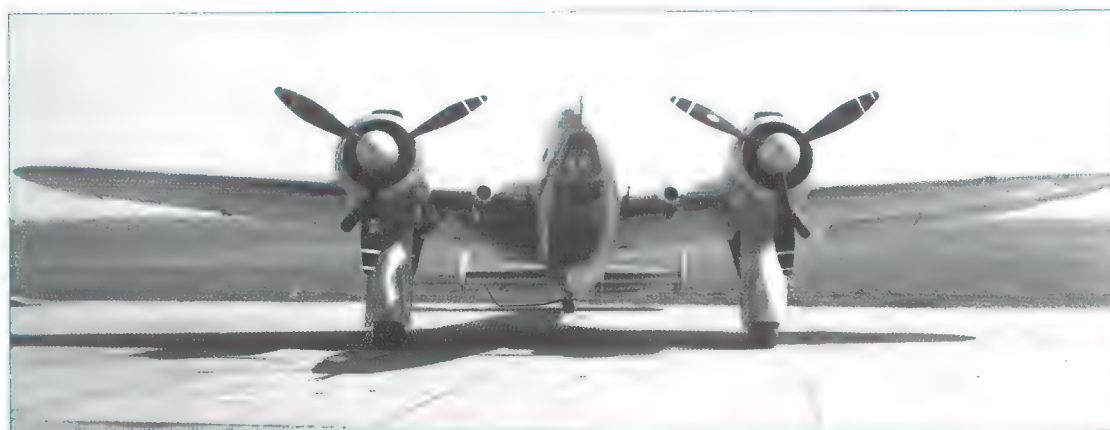
The work on the project and drawing finalization was continued following the signing of the contract. At the request of engineer Stankov, engineer Djordje T. Ducić joined the team as a secondary designer in August 1938, having resigned his previous post as technical director at Ikarus and joining Zmaj. A group of young engineers and technicians was also hired. Engineer Pavle Stanković was assigned static calculation work and engineers Ivan Šoštarić, Aleksandar Muhi and Emil Ladek were assigned aircraft construction refinement work. Engineer Milenko Djurić and technician Andrija Čonkin worked on armament, instrument and equipment placement. The factory constructed a full size mock-up of forward fuselage and cockpit, which had the pilot commands, instrument panel and other equipment and armament. VOG pilots made recommendations concerning the placement of certain equipment and instruments and these were adopted in the final design.

Special attention was given to technological problems concerning the wooden wing and stabilizer construction, which required strength and elasticity to attain the high design speeds. Wing was constructed from a single piece, with two spars formed in a special mould. The spars consisted of multiple layers of thin glued profiles of 5 x 5 mm cross section. Following the crash of Rogožarski IK-3 fighter in January 1939, which was presumed to be a result of wing spar breaking, engineer Stankov rechecked his calculations and decided that the already completed spars for the R-1 need to be strengthened by adding additional two layers. As a result of this decision, the designer came in conflict with the owners of Zmaj, who considered this modification unnecessary and expensive. In the end engineer Stankov

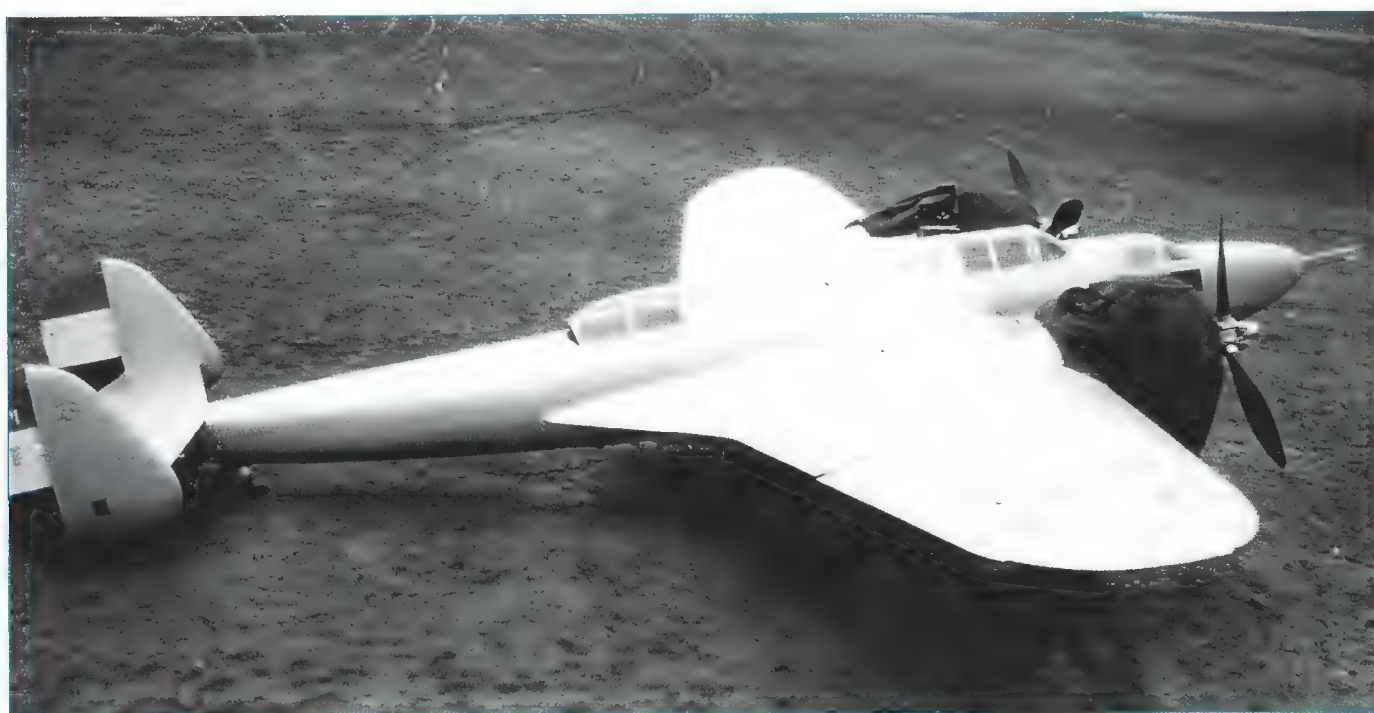
Zmaj R-1 during factory testing: (top) the machine was placed in a horizontal position for measuring purposes; (bellow) three-quarter view at Beograd Airport apron. (both Aviation Museum – Belgrade)

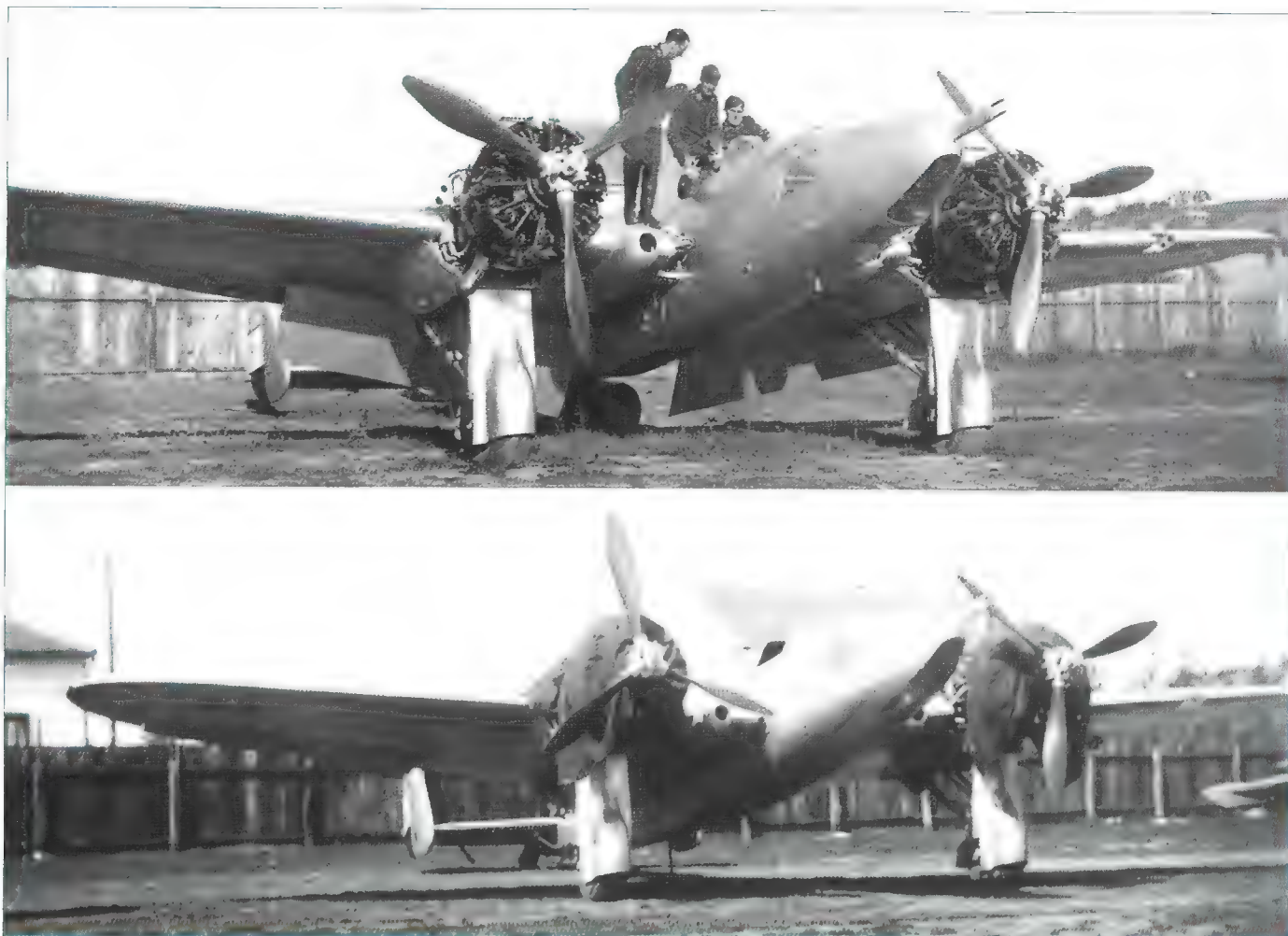


Zmaj R-1 head on view showing its sleek lines at Beograd Airport. Note that the 20 mm cannons were installed in the wing roots by military armorers. Contrary to the VV rules the “Kosovo cross” was applied under the port wing. (Aviation Museum – Belgrade)



Below: This photo was taken immediately following capture by German forces at Beograd Airport. Following the accident, the propellers were straightened by Ikarus factory however the engine nacelles were still not replaced hence engines were canvas covered. Starboard wing shows the “Kosovo cross” VV insignia. (Djordje Nikolić)





paid for these modifications out of his pocket. All calculations were conducted in accordance with the German DIN norms, with a safety factor of 11, as this was typical for the modern fighter aircraft types.

Metal fuselage was constructed using a special jig, which was an entirely new process implemented for a domestically constructed aircraft. The cockpit area consisted of two levels, which enabled the pilot and the navigator/radio operator better visibility. This was further improved by adding side windows framed with Plexiglas at the front cockpit and large opening in nose which was to be used for aiming during bombing runs. The navigator/radio operator entered the aircraft via a large door below the fuselage, which reduced the danger from an accidental propeller strike and enabled an easier exit from the aircraft in case of an emergency. Pilot's and rear gunner's canopies both slid backwards, which for the gunner simplified aiming the machine gun and reduced air vortexing during flight.

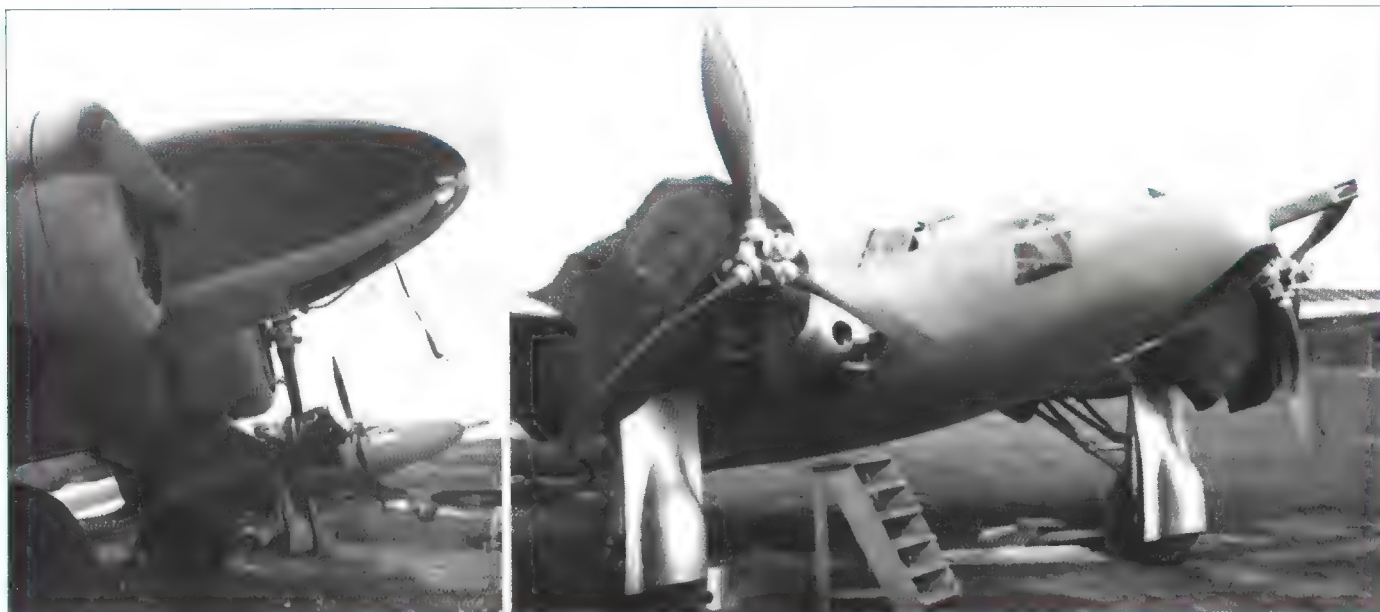
The construction of the prototype started at the beginning of 1939 and it was completed at the beginning of January 1940 at Zmaj hangar at Zemun. Following the completion of the assembly process, functionality of landing gear and other hydraulics and electrical devices was tested, and the aircraft was dismantled and transported to the large "C" hangar belonging to VOG at the Beograd Airport where it was reassembled. With the help of military armourers, cannons and a machine gun on the left side of the fuselage were installed and a temporary cover was placed over the opening of the other machine gun. The twin rear facing machine gun and some of the equipment were not installed during the initial flights.

Captured Zmaj R-1 at Beograd Airport: (top) curious German soldiers inspecting the machine (note that the canvas from the nacelles was removed showing the exposed engine and weapons which were dismantled); (below) the same scene with covered engine nacelles. (both Jan van den Heuvel).

Flight testing

The selection of the test pilot for R-1 proved difficult since the current Zmaj test pilots never flew twin engine aircraft, VOG pilots were not permitted to conduct factory test flights since these were contractually a requirement of the factory. It was finally decided to assign flying to reserve lieutenant and Aeroput Airlines' pilot Djura E. Djakonović. Since 1 September 1938 he flew company's Lockheed L-10A Electra airliners. In spite of being a solid passenger aircraft, it differed substantially from the R-1, which had stronger engines, flew faster, and used different and more complex equipment which in reality required a pilot with greater experience than Djakonović.

Following familiarization with the aircraft and its ground taxiing performance, Djakonović conducted a test flight on 28 March 1940 having taken off from Beograd Airport. The take off was short and



Another two shots at Beograd Airport: (left) R-1 can be seen behind the nose of Ikanus-refurbished and newly camouflaged ex VV Caproni Ca-310 Libeccio (Djordje Nikolić); (right) front part of fuselage and canvas covered nacelles, note the front ring gun-sight in front of pilot's windscreen. (Jan van den Heuvel)

safe, however due to problems with increased oil temperature and landing gear retracting installation, the entire flight was conducted with extended landing gear. At the altitude of 3,000 m, the pilot concluded that aircraft reacts well to all inputs, but that the ailerons move with difficulty. He then tested the aircraft characteristics with reduced engine output, first with the left and then with the right engine, in both cases the aircraft maintained direction and altitude. When pilot attempted to increase speed, due to the extended landing gear the aircraft began to shudder, so he immediately pulled back on the throttle. In spite of flaps not being fully retracted, it was determined they were efficient, however due to incorrect instrument readings it was not possible to determine the climbing speed and other flight parameters. The pilot as a result tested the behaviour in short turns concluding it was satisfactory and performed a chandelle prior to landing, which was included in the first test flight program. The landing was performed safely with semi extended flaps.

As time was needed to resolve some of the deficiencies discovered during the first flight, Zmaj R-1 was ready to continue flight testing on 16 April 1940. Testing proved that aircraft has a good rate of climb and Djakonović twice checked maximum flight speed. During the second attempt at full throttle, he attained an instrument speed of 340 km/h which corresponded to an actual speed of 425 km/h. The pilot also tested climb rate with one engine shut off during which the aircraft attained 1 to 2 m/sec, proved that trim tabs work as expected and that difficulties operating the ailerons were resolved. However, minor difficulties with flaps and landing gear manifested again. The total flight time was 50 minutes.

During the third flight on 17 April 1940, Zmaj R-1 climbed to 5,000 m in 9 minutes with full fuel tanks. Pilot indicated that it was possible to reduce the climb time even further, since he spent time gathering data while climbing and was as a result not able to maintain optimal throttle. At the altitude of 4,000 m, while measuring the maximum speed again at full throttle and increased compressor boost, he attained an instrument speed of 360 km/h which corresponded to 450 km/h actual speed. When pilot began the descent process and reduced throttle, alarms signalling landing gear was extending came on and soon enough smoke started coming from *Жиронестор* (Gyronestor) artificial horizon, which was connected to the aircraft exhaust system. To extinguish the fire, pilot began a steep descent with intent to land as soon as possible. During the descent the extended and retracted the landing gear several times. As the wheel touched the ground and the aircraft rolled for some 30 m, the landing gear began to retract again and the aircraft slid for approximately 150 m on its fuselage before coming to a stop. As a result of the crash landing, the landing gear mechanism was damaged, Hamilton propellers were bent, propeller pitch mechanism was damaged, tail wheel tire was ruptured but the fuselage remained largely intact. Djakonović wrote in his report that he observed with absolute certainty that the landing gear indicators showed it was extended following which he placed the lever in neutral position. He had no good explanation why first the right and then left landing gear leg began retracting during landing. This information suggests that the accident was most likely caused by troublesome hydraulics installation and pilot inexperience since he did not react appropriately in such complex situation. All involved with the project were disappointed since R-1 showed so much promise during first flights. It was able to meet all aerodynamic and performance expectations.



After Accident

The accident effectively put an end to flight testing indefinitely. In spite of the efforts by the owners and factory personnel acquire replacement parts for the landing gear, which the Germans delayed with the pretence of war situation and the replacement parts for the engines, which the French delayed for the same reason. The straightening of the propellers was assigned to Ikarus factory, which at the time was getting ready to start the manufacture under license of Hamilton propellers. However, due to inexperience with such complex process at Ikarus, this prolonged for five months. When Zmaj R-1 was finally repaired in March 1941, test flights were not possible due to impeding war situation. In the meantime, Zmaj factory selected a new pilot to continue test flights if at all possible.

At the time of German attack against KJ, Zmaj R-1 was located in the VOG hangar at Beograd Airport. Even though it was still not delivered to VV, Germans declared it as war booty and confiscated it, and they duly submitted a written note to Zmaj factory on 16 October 1941 to that effect. The aircraft was later destroyed along with other VV in an elaborate sabotage to prevent falling in the enemy's hands.

The unrealized plan from autumn of 1940 to rearm the VV reconnaissance units, intended for all reconnaissance aircraft to be of domestic construction. According to this plan 11.VG for long range reconnaissance was to be armed with Zmaj R-1.

Based on the partially preserved calculations and drawings for Zmaj R-1, engineer Stankov after the war constructed a twin engine aircraft designated as Type 215 whose prototype was constructed at Ikarus in 1951 and used until 1957.

Zmaj R-1, German war booty at Beograd Airport: (top) aft three-quarter view showing the asymmetrically positioned VV "Kosovo Cross" insignia on the starboard wing upper side; (below) port profile (both Jan van den Heuvel). Aircraft will be destroyed not long thereafter in a deliberate act of sabotage.

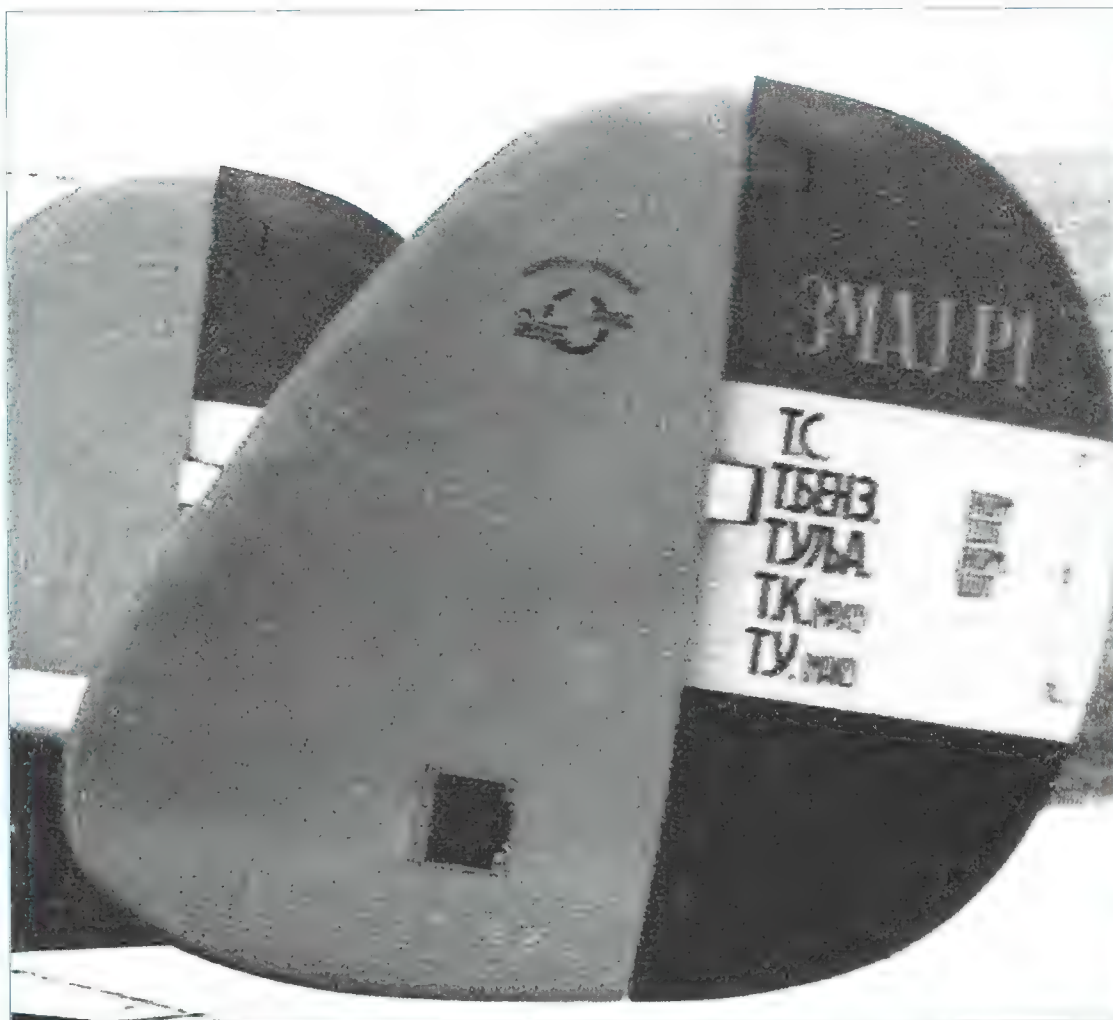
Versions

Depending on the role, Zmaj R-1 could be configured in three different versions:

Heavy Fighter (Destroyer)

Twin seater, crew consisting of pilot and gunner. Offensive armament was controlled by the pilot using a mechanical gun sight. Aircraft was armed with two 20 mm HS 404 cannons at the wing root which enabled the gunner to replace ammunition drums in flight and two 7.92 mm M.38 (FN Browning) machine guns in the fuselage at the pilot level. The defensive armament consisted of twin 7.92 mm M.38 machine guns in a rear facing turret, which was operated by the gunner.

Details of the outer sides of both R-1 vertical tails. Note the newly introduced Zmaj logo in colour: Yellow Dragon outlined with Blue line, Blue letters and Black circle. Black weight abbreviations were without particular values. All letters were in Serbian Cyrillic. (Šime Oštrić)



Fine port rear three-quarter shot of captured Zmaj R-1 destroyer pictured by Germans at Beograd Airport. Note the walkway on the port wing, rear canopy in retracted position and the absence of dorsal hatch and engine cowlings. Rudder inscriptions and final Zmaj logo on the vertical tail plane can be clearly seen. (Jan van den Heuvel)

Light Bomber

During bombing missions, the crew would consist of the pilot and the navigator, R-1 would carry four 106 kg VISTAD-built Stanković bombs. By using special electrically actuated pylons, bombs could be jettisoned from the fuselage while diving which improved higher efficiency when bombing smaller targets. When bombing troop concentrations, it was possible to install within the bomb bay cluster munitions of small calibre. The two part bomb bay doors were hydraulically operated by the pilot.



Reconnaissance

In reconnaissance role, the aircraft carried three crew members: pilot, observer and radio operator/gunner. Instead of cannons, which were easily removable, an additional fuel tank would be installed which increased range by 40%. Radio station was placed between the pilot and the radio operator/gunner cockpits.

Camouflage and markings

Designation

The project was known as Zmaj Destroyer №1. Factory designation was Zmaj-1 or Zmaj I. Generally known as Zmaj R1, official VV designation was R-1.

Livery

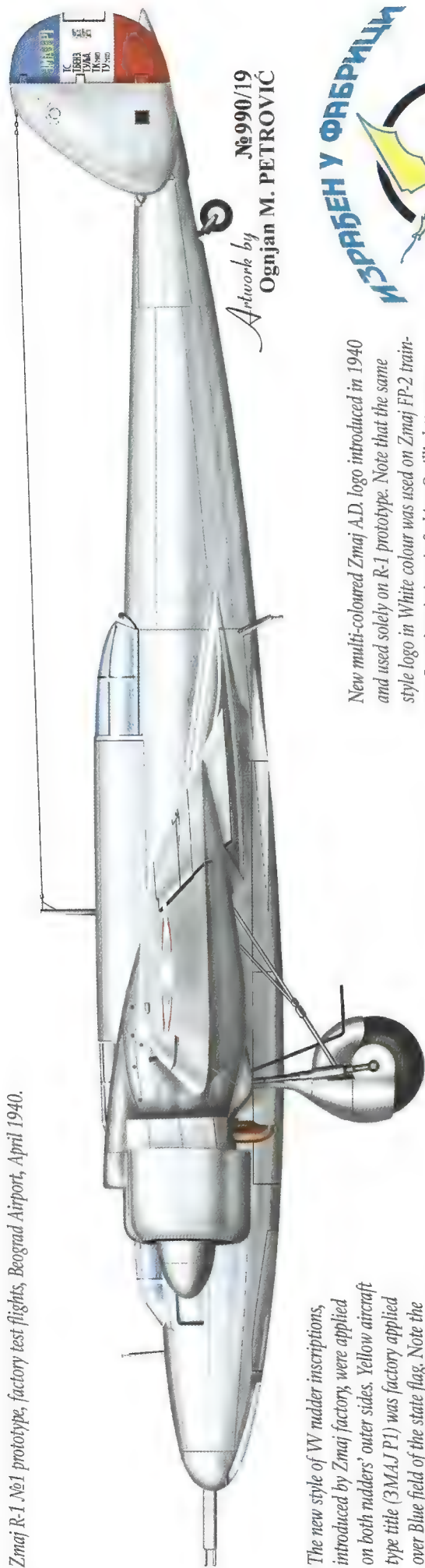
The entire aircraft was Silver in color. Metal surfaces remained in highly polished natural Aluminum while wooden surfaces were painted in Silver doped color.

Insignia and inscriptions

The VV national insignia, two 120 cm diameter "Kosovo crosses", were placed asymmetrically, on the underside of the port wing and on top side of the starboard wing, which was opposite of the VV standard requirements. The state flag was painted on both sides of the rudders.

In the accordance to the standard VV practice, aircraft type was written in Yellow colour on Blue flag surface and weight characteristics were written in Black colour in White flag surface. All inscriptions were in Serbian Cyrillic letters. On the outside surfaces of vertical stabilizers, new-created Zmaj factory logo was applied.

| Aircraft Characteristics Zmaj R-1 | |
|-----------------------------------|---|
| Quantity used: | 1 |
| Crew: | 2 or 3 |
| Years of Service: | 1940–1941 |
| Span: | 14.4 m (47.2 ft) |
| Length: | 12.8 m (41.9 ft) |
| Height: | 2.5 m (8.2 ft) |
| Wing area: | 33.8 m ² (364 ft ²) |
| Engine: | Two 680 mhp (671 hp) Hispano Suiza 14 Ab 02/03 |
| Empty weight: | 2,600 kg (5,732 lb) |
| Loaded weight: | (heavy fighter) 5,094 kg (11,230 lb) (light bomber) 5,664 kg (12,487 lb) (reconnaissance aircraft) 5,421 kg (11,951 lb) |
| Maximum speed: | 475 km/h (295 mph) at 4,300 m (14,107 ft) |
| Service ceiling: | 10,000 m (32,808 ft) |
| Climb to 5,000 m: | 7 min 42 sec |
| Range: | 1,200 km (745 ml) |
| Armament: | Four (two fixed forward facing, two twin rear facing and movable) 7.92 mm M.38 (FN Browning) machine guns (all versions), two 20 mm HS 404 cannons (heavy fighter), 400 kg bombs (light bomber) |



Artwork by
№990/19
Ognjan M. PETROVIĆ

The new style of VV rudder inscriptions, introduced by Zmaj factory, were applied on both rudders' outer sides. Yellow aircraft type title ('ЗМАЈ Р1') was factory applied over Blue field of the state flag. Note the factory applied aircraft weights abbreviations with particular weights not yet written in because VOG had not yet completed official measurements.

New multi-coloured Zmaj A.D. logo introduced in 1940 and used solely on R-1 prototype. Note that the same style logo in White colour was used on Zmaj FP-2 trainers. Logo inscriptions in Serbian Cyrillic letters mean: made at factory (израђен у фабрици), Zmaj (Змај), Zemun (Земун). The logo colours were determined (estimated) in relation to the flag colours and Yellow on the ZMAJ title.

Side view showing rear gunner's canopy which slid backwards, simplifying aiming of the machine gun and reducing air vortexing during flight. (Aviation Museum – Belgrade)

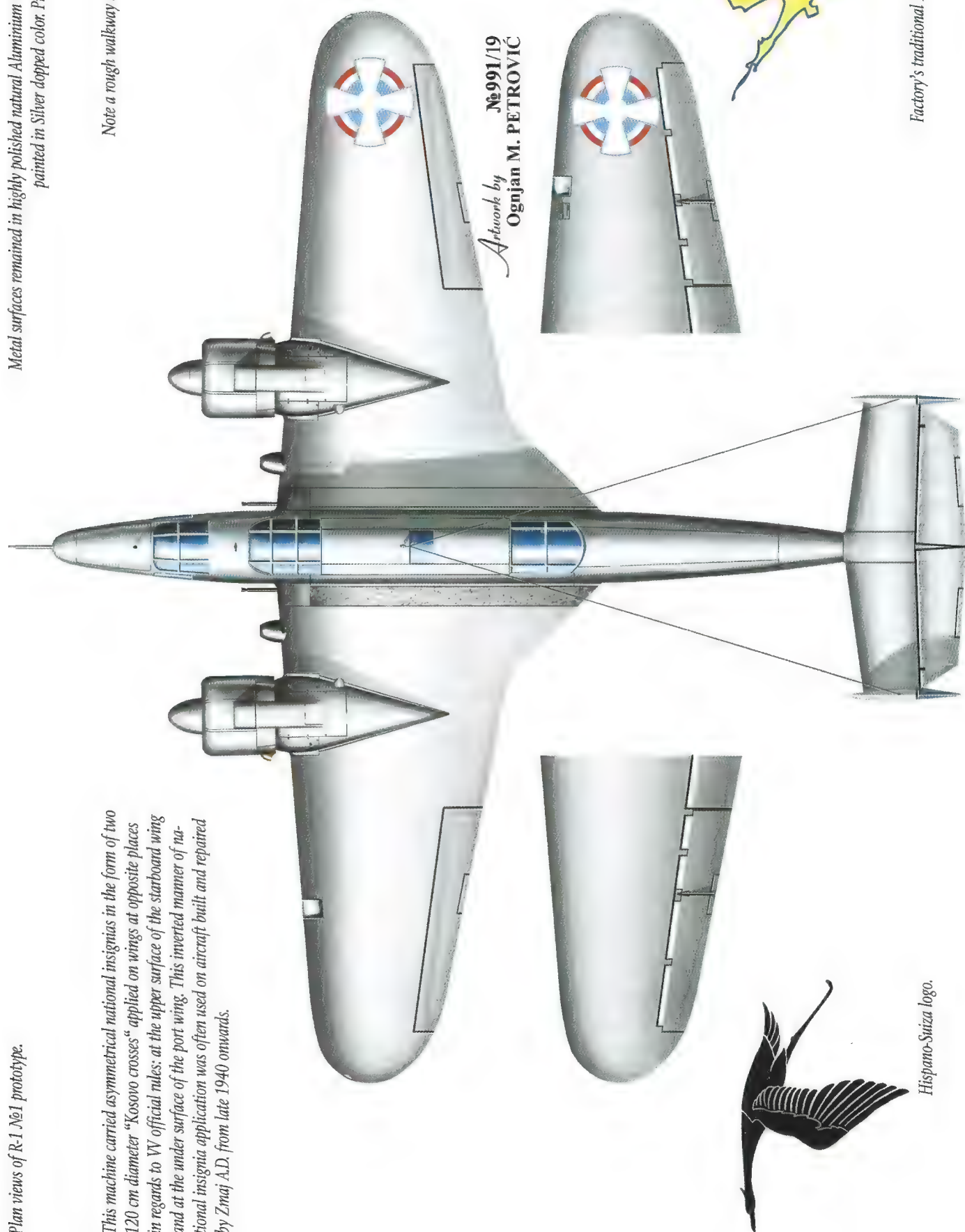


Plan views of R-1 №1 prototype.

This machine carried asymmetrical national insignias in the form of two 120 cm diameter "Kosovo crosses" applied on wings at opposite places in regards to VV official rules: at the upper surface of the starboard wing and at the under surface of the port wing. This inverted manner of national insignia application was often used on aircraft built and repaired by Zmaj A.D. from late 1940 onwards.

Metal surfaces remained in highly polished natural Aluminium while wooden surfaces were painted in Silver dopped color. Propellers were painted Black.

Note a rough walkway at the root of the port wing.



Hispano-Suiza logo.



Factory's traditional Dragon from coloured logo.

Ikarus Orkan

Background

Conceptually, Orkan (Hurricane) was a modern, fully metal twin engine and twin seat high wing aircraft, which was classified by VV as „авион за борбу, бомбардовање и извиђање” (aircraft for combat, bombardment and reconnaissance) or „авион за вишеструку употребу“ (multi-purpose aircraft). It was designed in such a way that with simple swap of the equipment, it was possible to use it in both offensive and defensive fighter missions, for short (patrol) and long range (strategic) reconnaissance and for short (daylight) and long range (night) bombing missions as well as for liaison roles. As described in the Yugoslav Aviation Yearbook (*Годишњак Југословенског ваздухопловства*) 1941 edition, its modern design reflected in the use of equipment and commands which were considered as most perfected technical achievements of the time („опремљен свим уређајима и комадама данашњег најсавршенијег техничког прогреса“). It was considered as one of the most modern aircraft in its category with respect to the performance and armament. At two thirds throttle, it reached the speed of 400 km/h, which indicated that Orkan could easily attain the planned 545 km/h. It was faster and had a higher rate of climb than its contenders, the R-1 and R-313.

Prototype design

Engineer *maj* Sava M. Momčilović, VV Headquarter's Technical Officer, decided to start working in private at the beginning of 1936 on a project for a modern fast bomber. He chose the high wing concept with unusually clean lines and proposed using the French Hispano Suiza 14 Ab radials. The new aircraft was named Orkan and in the fall of 1936, he was joined by young engineer *kap* Ik Dušan B. Radojk-

HH Prince Paul (Pavle Karađorđević) of Yugoslavia taking a close look at the Ikarus Orkan model during a visit to the First International Aeronautical Exhibition held in Belgrade between 28 May and 13 June 1938. Note the first VV Bristol Blenheim Mk.1 №1 in the background (Aleksandar Ognjević)



ović. Later on, in 1937, to provide part time help with the design of certain construction sub-assemblies, young engineers Ivan I. Šoštarić and Stanislav D. Marjanović joined the team. This project initially designated as M.I.S. (Momčilović Ing. Sava) was completed in 1937 and the VV HQ accepted its entry into the competition with the two other projects from Zmaj and Rogožarski factories. The model (with assigned designation MIS Z № 1) was tested at the Eiffel wind tunnel in Paris and following evaluation of obtained results, the VV HQ placed an order on 14 March 1938 for the construction of a single prototype at Ikarus factory located in Zemun. The delivery date listed in the contract was set for 14 June 1939 and it was expected to complete the prototype in 49,000 man hours. The contract defined the price

of 6,385,582 D for the prototype manufacturing, including the purchase of engines, weapons and license payments. Soon after the signing, all further work on project documentation was transferred to the Ikarus' design bureau and the project team was expanded accordingly. At the end of May 1938 Orkan model with Hispano Suiza engines was presented at the First International Air Exhibition at Belgrade. Well-known monthly Aviation Herald published the same month a long text about bomber aircraft which contained an extensive article about Orkan.

Designed as an all metal aircraft, fuselage consisted of Duralumin longerons which were supported at locations seeing the most stress. The wing construction consisted of two Duralumin spars joined together with ribs manufactured from the same material. The fuselage and wing were covered with thin Duralumin plates which were riveted to one another. All controls were hydraulically operated. To enable best possible visibility from the cockpit, the entire nose and part of the wing root were made from Plexiglas. The pilot entered the cockpit through a hatch in the top and the gunner from through a extending turret canopy located in mid fuselage. Tail surfaces consisted of twin vertical stabilizers. Engines were mounted on high strength steel tubing to which also the landing gear mechanism attached. Engines powered three bladed metal variable pitch type Constant Speed propellers manufactured by Hamilton.

The installed equipment was so innovative that all the main instruments were equipped with both sound and light alarms which activated at either minimum or maximum flight parameters. Such features helped the pilot concentrate on flying and combat without constantly having to observe the instruments. These instruments were sourced locally from *Mikron* and *Teleoptik* instrument companies. For high-altitude flights, an oxygen installation with two *Teleoptik* M-38 inhalers was installed. The communications between crew members was maintained using an aviophone. A radio station and an automatic camera were envisioned for the first prototype but were never installed. Hydraulic installations were specially designed for Orkan and manufactured by famous French *Messier* company, which specialized in such work.

The armament was at first (according to the original Specification) to consist of substantial quantity of cannons and machine guns (two HS 404 cannons in the nose, two machine guns at the sides of the fuselage, one *Oerlikon* cannon in the turret and one downward facing machine gun). At the request of the VV HQ (according to newly assigned Specification), the armament was reduced to only one 20 mm HS 404 cannon (with 60 rounds) and two 7.9 mm M.38 machine gun (with 250 rounds per gun) facing forward and one 20 mm *Oerlikon* cannon, or if not possible to install it, one heavy 12.7 mm *Breda-SAFAT* MC.12,7 machine gun (with 500 rounds) facing backward installed on hydraulically operated turret. Fuselage was designed to carry internally a total of four 106 kg *Stanković* bombs. According to special launchers Orkan was capable of dive-bombing.

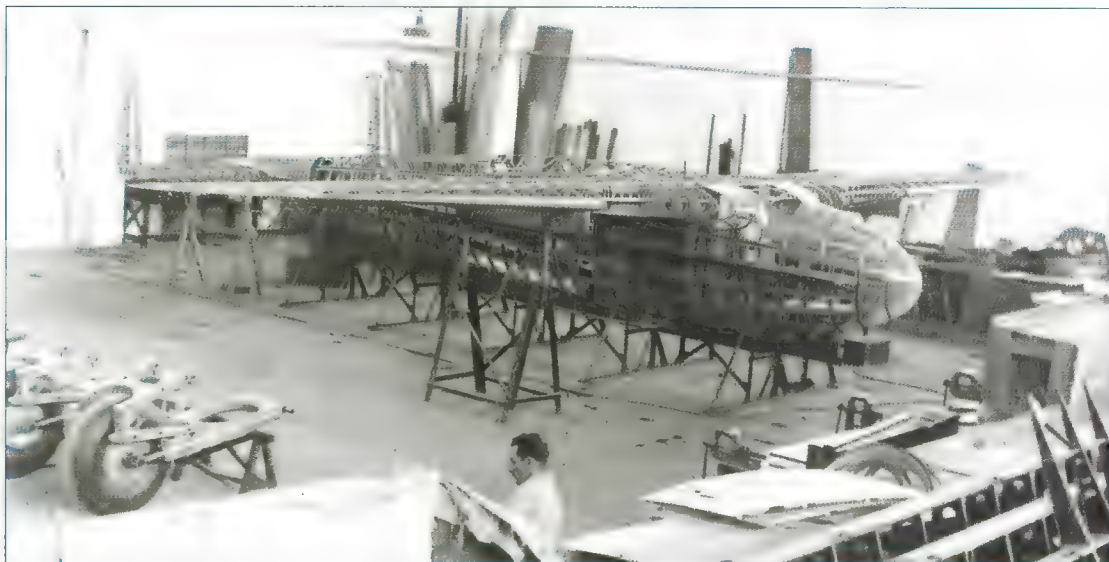


Some of Ikarus design team members pictured beside the Orkan model at Ikarus design bureau on 14 May 1939. (Šime Oštrić via Ognjan Petrović)

Prototype construction

Despite the delays in completing the factory documentation, prototype was planned to have its first flight by the end of 1939. However, the engines ordered from France were never delivered due to the start of World War II. Due to the inability to source the originally intended French Hispano Suiza 14Ab engines, which had one of the smallest radial engine diameters available at the time, designers and Ikarus management made a decision (at the end of November 1939) to purchase FIAT engines which were a version of French Gnôme-Rhône 14K. As a result, Orkan prototype incorporated two air-cooled 14-cylinder two-row FIAT A.74 RC.38 radial piston engines, geared and supercharged, rated nominal-

The sole Orkan prototype in the early stages of construction at the Ikarus A.D. factory. Due to the inability to source French made engines, significant redesign was required to incorporate the alternate Italian engines, which resulted in the first flight being pushed back to 24 June 1940. (Čedomir Janić)



ly 840 mhp at 3,800 m at 2,400 rpm and 890 mhp at 2,280 rpm for take-off. Propellers were Italian license-built Hamilton Standard. Increased engine power lead to new specifications which required changes in characteristics, reduced weaponry (two cannons instead of three) and improved performance.

Even though prototype construction was complete in April, due to the required rework to engine nacelles to fit the new engines and relocate certain equipment to compensate for added weight, a lot of precious time was lost which resulted in unarmed Orkan taking off from Beograd Airport for the first time on 24 June 1940. During its first flight which lasted some 14 minutes, it was piloted by *kap Ik* Dušan Milojević who during landing lost speed and dropped 5-6 m height suddenly which resulted in structural damage to the prototype whose landing gear was damaged, propellers were bent, engine nacelles were deformed and fuselage belly damaged. The accident investigation commission as a result of the crash landing had doubts in the Orkan's airworthiness and ordered that wind tunnel testing in Paris gets repeated. As the results confirmed previous findings, Ikarus commenced with the prototype repair at once.

To make matters worse, sourcing new landing gear and propellers proved difficult hence the repairs continued until mid-March 1941. The restart of flight testing was this time performed by highly skilled Ikarus test pilot Vasilije J. Stojanović who from 19 March until 5 April 1941 completed a total of 13 flights. These tests flights enabled the validation of Orkan flight performance, which was praised by the pilot. At two thirds throttle, Orkan reached the speed of 400 km/h and the pilot pushed it to full throttle although for just one minute due to vibrations observed on one of the engines. The VV HQ already placed an order for first series construction however due to the start of war it was never materialized. Similarly, FIAT's offer for 40 A.74 engines dating in March 1941 was not fulfilled either.

1941 April War

During the VV re-arming process from spring 1939 until 1940, it was intended to procure a total of 39 twin engine fighters to equip the 51.VG and 52.VG. Since no purchase was fulfilled from abroad, both groups received temporarily single engine fighters which they used in April War. After the conclu-

The completed prototype at Beograd Airport. Its sleek lines enabled it to rightfully be one of the most modern aircraft in its category with respect to achieved performance. (1941 Yugoslav Aviation Yearbook)





During the strafing attack by German fighters on Beograd Airport, Orkan was damaged. It was subsequently captured at the same location and then according to the witness accounts loaded on a freight train bound for Germany in September 1941. (Aviation Museum – Belgrade)

sion of domestic twin engine prototypes testing, VV HQ decided that 51.VG should get equipped with R-313 fighters and 52.VG with Orkan fighters.

Orkan prototype completed the assigned flight testing imminently before the war, and on 6 April 1941 it was transferred to VOG. During the German attack against Beograd Airport, Orkan was damaged in a strafing attack by German fighters. After the war, Germans captured Orkan *Zerstörer* (as was written in German documents listing captured aircraft), handed it over to *Luftflotte 4* on 24 April 1941 and transported it to Germany according to the eyewitness accounts in September. The machine was disassembled, mounted on a train carriage and never to be heard of again. There is no additional information about its fate, but according to some unproved rumours it was tested at Junkers factory in Dessau. A bill of lading for Ikarus Orkan and the experimental prototype B-5 is preserved at the Railway Museum in Belgrade.

Camouflage and markings

Orkan prototype remained in natural Aluminium finish and lacked any markings and inscriptions. According to the contract, it was intended to be painted in Aluminium colour and have standard national markings applied on wing and tail surfaces.

Drawings of camouflaged Orkan, which could be found on the internet, are a pure fictional work made without any documented substantiation, there is no proof that Orkan was ever intended to be painted with a camouflage scheme.

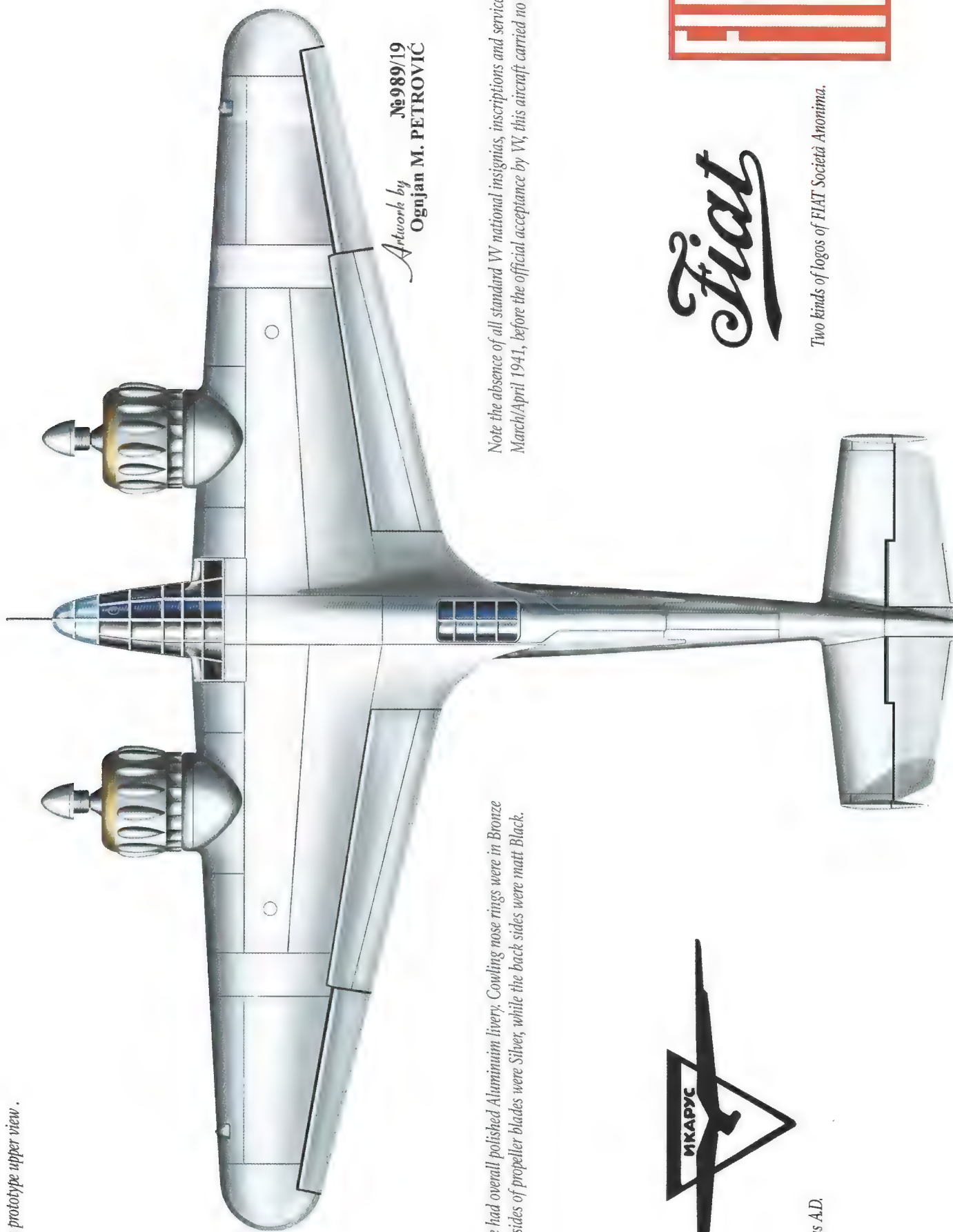
| Aircraft characteristics Ikarus Orkan (1) | |
|---|---|
| Quantity used: | 1 |
| Crew: | 2 |
| Years of Service: | 1940–1941 |
| Span: | 13.3 m (43.5 ft) |
| Length: | 10.0 m (32.8 ft) |
| Height: | 3.2 m (10.5 ft) |
| Wing area: | 26.0 m ² (280 ft ²) |
| Engine: | Two 840 mhp (829 hp) FIAT A.74 RC.38 |
| Empty weight: | 2,870 kg (6,328 lb) |
| Loaded weight: | 4,500 kg (9,923 lb) |
| Maximum speed: | 545 km/h (339 mph) at 4,000 m (14,765 lb) |
| Service ceiling: | 11,000 m (36,091 ft) |
| Climb to 4,000 m: | 4 min 12 sec |
| Range: | 1,200 km (746 ml) |
| Armament: | One fixed 20 mm HS 404 cannon (2), three (two fixed, one flexible) 7.92 mm M.38 (FN Browning) machine guns, one flexible 12,7 mm Breda-SAFAT MC.12,7 (3), four 106 kg Stanković bombs |

- (1) The performance data was obtained through calculations by using the Fiat engine and 4,500 kg take-off weight. According to final Specification fuel and oil weighed 710 kg, payload 920 kg. Weight is approximate as final weight was obtained by measuring however no records are available to confirm the exact values.
- (2) It was originally intended to arm the aircraft with two HS 404 cannons (installed in the sides of the front fuselage), however at the request of VV HQ it was reduced to only one cannon at the very end of prototype construction.
- (3) The initially selected rear facing 20 mm M.39 (Oerlikon FF) cannon in a turret was replaced at the request of the VV HQ with a 12.7 mm heavy machine gun.



A fine shot showing an all-metal construction in natural Aluminium livery, with the prototype evidently lacking markings. Orkan was intended to be painted in Aluminium colour and have national insignia applied, but this did not take place before the start of the 1941 April War. (Aviation Museum – Belgrade)

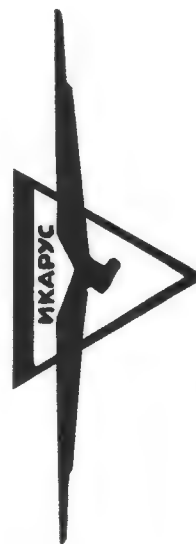
Ikarus Orkan prototype upper view .



Artwork by
Ognjan M. PETROVIĆ
№989/19

This machine had overall polished Aluminium livery. Cowling nose rings were in Bronze metal. Front sides of propeller blades were Silver, while the back sides were matt Black.

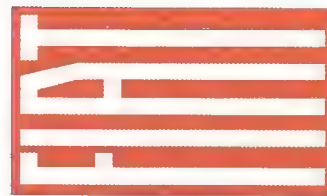
Note the absence of all standard VV national insignias, inscriptions and service stencils. In March/April 1941, before the official acceptance by VV, this aircraft carried no markings.



Logo of Ikarus A.D.

Fiat

Two kinds of logos of FIAT Società Anonima.



Messerschmitt Bf 110C-4 (VV Me-110)

Background

The concept of strategic fighter, or *Kampfzerstörer* (Battle destroyer), caught the imagination of *Reichsmarschall* Hermann Göring, commander-in-chief of the *Luftwaffe*. Based on his orders the technical specification was issued for a twin engine all metal three seat monoplane armed with a large caliber cannon and an internal bomb bay. The representatives of Arado, Dornier, Focke-Wulf, Heinkel, Henschel, Gotha and Messerschmitt were handed off these specifications but only Messerschmitt, Focke-Wulf and Henschel submitted their design proposals. Focke-Wulf and Henschel were immediately awarded contracts for three prototypes each as their proposals closely met the requirements. Messerschmitt on the other hand deviated from the requirements and focused on performance but under the pressure from Ernst Udet, *Luftwaffe* director of research and development, was awarded contract for the prototype construction. The first prototype, Bf 110V-1 took off on 12 May 1936 from Augsburg with Rudolf Opitz at the controls. Few days later this aircraft attained astounding 505 km/h in level flight, which was faster than the single engine Bf 109B-1 which was entering the fighter units. Henschel with its Hs-124 and Focke-Wulf with Fw-57, due to following the original specification, did not meet the *Zerstörer* role requirements, hence Messerschmitt's Bf 110 was declared winner and entered series production. The prototype and the A-0 series machines were powered with DB.600a engines, which were soon replaced with Jumo 210B. Neither of the engines provided the desired performance but in the late 1938 the DB-601A-1 was finally certified for installation in production aircraft. *Luftwaffe* embraced the new weapon and even created a new type of a unit called *Zerstörergruppen* (destroyer air groups). Original *Luftwaffe* designation, Bf 110, was assigned before Bayerische Flugzeugwerke became Messerschmitt AG in July 1938. This event led to the fact that the designation Me-110 was never officially introduced, although it was used in jargon.

Luftwaffe used approximately 6,000 of these heavy fighters and light bombers in five basic versions: B, C, D, E, and F as well as the night fighter version G. Each of the main versions consisted of several sub-variants.

Heavy fighter version Bf 110C-4 was powered by 12-cylinder inverted-Vee liquid-cooled DB.601A-1 with 1,100 mhp for take-off, 1,020 mhp maximum (5 min) at 4,500 m, 960 mhp while cruising at 5,000 m and 860 mhp during economic cruising at 4,000 m. The aircraft was armed with offensive weapons which consisted of four forward firing 7.92 mm Rheinmetall-Borsig MG-17 machine guns in the nose with 1,000 rounds per gun each and two 20 mm Oerlikon FF/M cannons with 200 rounds per gun each. Each cannon had two drums with 100 magazines each. When the ammunition from the first magazine was exhausted, the gunner had to manually replace it with another one. A defensive weapon was one flexible Rheinmetall-Borsig MG-15 machine-gun at the rear seat with 750 rounds per gun. The gunsight was Oigee Revi C12/d while the radio station was Telefunken FuG IIIa. The C-4 was the first of the C series to have the armor protection added for the crew.

Kingdom's interest in the *Zerstörer*

Intending to equip two aviation groups, VV formally requested that Germany delivers the Me-110. Since all hope was lost that France would deliver their Potez 63, and the domestic industry struggled to produce a viable twin engine aircraft, purchasing such fighters from Germany was the only solution for the VV. Unfortunately, Germans duly refused the sale citing that "Ju-88 and Me-110 are not intended for sale". They even refused to release basic technical characteristics which VV HQ Technical Department could study to evaluate the viability of such machines for its service.

1941 April War

At the time of the German attack against the KJ, *Luftwaffe* used various sub-variants of Bf 110C/D and Bf 110E series. On 1 April 1941 at 18:30 one Bf 110C-4 with a crew of three landed by mistake at Kraljevo Airport. During questioning the crew admitted to have taken off at 15:50 from Vienna towards Turnu Severin in Romania and that they lost orientation due to poor weather. As a result traveling over Belgrade they arrived to Kosovska Mitrovica and then turned back towards Kraljevo. As a result of this event, VV had the unique opportunity to inspect the Bf 110. Following the orders from the HQ, the aircraft was transferred to VOG hangar and was disassembled to take photographs of sub-assemblies, instruments and radio navigation equipment. Regrettably, no one photo of that aircraft today is known to exist. On 7 April VTZ personnel hastily painted the machine in standard VV three tone camouflage and applied VV insignia.

The order was issued to transfer the Bf 110 from Kraljevo to Veliki Radinci auxiliary war airfield and to enter service with 51.VG which already had two twin engine Potez 63 on strength. The crew consisting of pilot *rez kap Ik* Zlatko Dimčović, who was assigned to 102.E, and machine gunner *nar djak* Gustav Ajdič took off on 8 April at 11:00 from Kraljevo towards Beograd and in spite of poor weather, low clouds, unfamiliarity with the aircraft managed to land the aircraft successfully. In route they were fired on by own anti-aircraft defenses around Kragujevac. After landing at Beograd Airport, pilot Dimčović was told by the 1.LB CO *puk* Dragutin Rubčić to transfer to Veliki Radinci auxiliary war airfield. Ajdič could not join him as he had to report to 1.E at Novi Sad. As a result, Dimčović conducted a solo flight in mid day towards Veliki Radinci. According to his account of this flight, he flew over the airfield at low altitude and speed with lowered landing gear, signaling that he wishes to land. He turned around and attempted to lower his flaps which were inoperable. As a result, his landing speed was greater than desired and in spite of going in for an early landing, the tail wheel touched the ground mid runway. He began to brake but the brakes were inoperable as well. The aircraft rolled the entire remainder of the runway and came to a stop some 20 m from the edge of the airfield. He left the aircraft and decided to come back tomorrow and inspect why the brakes failed.

The aircraft would never fly again. On 12 April, it was torched along with the Me-109s, IK-3s, Hurricanes and a sole IK-2 to prevent capture by the advancing German troops. Being that Bf 110 was the furthest away, some 2 km away from the rest of the aircraft, it was set to be torched first but the truck with soldiers paused by the closest Bf 109 and started the destruction there. It is certain however, that the aircraft was destroyed some time that day.

Camouflage and Markings

Type designation

The official VV designation was simply Me-110, following the Me-109 analogy.

Serial numbers and Codes

No information is available concerning this aircraft's serial numbers and codes.

Insignia

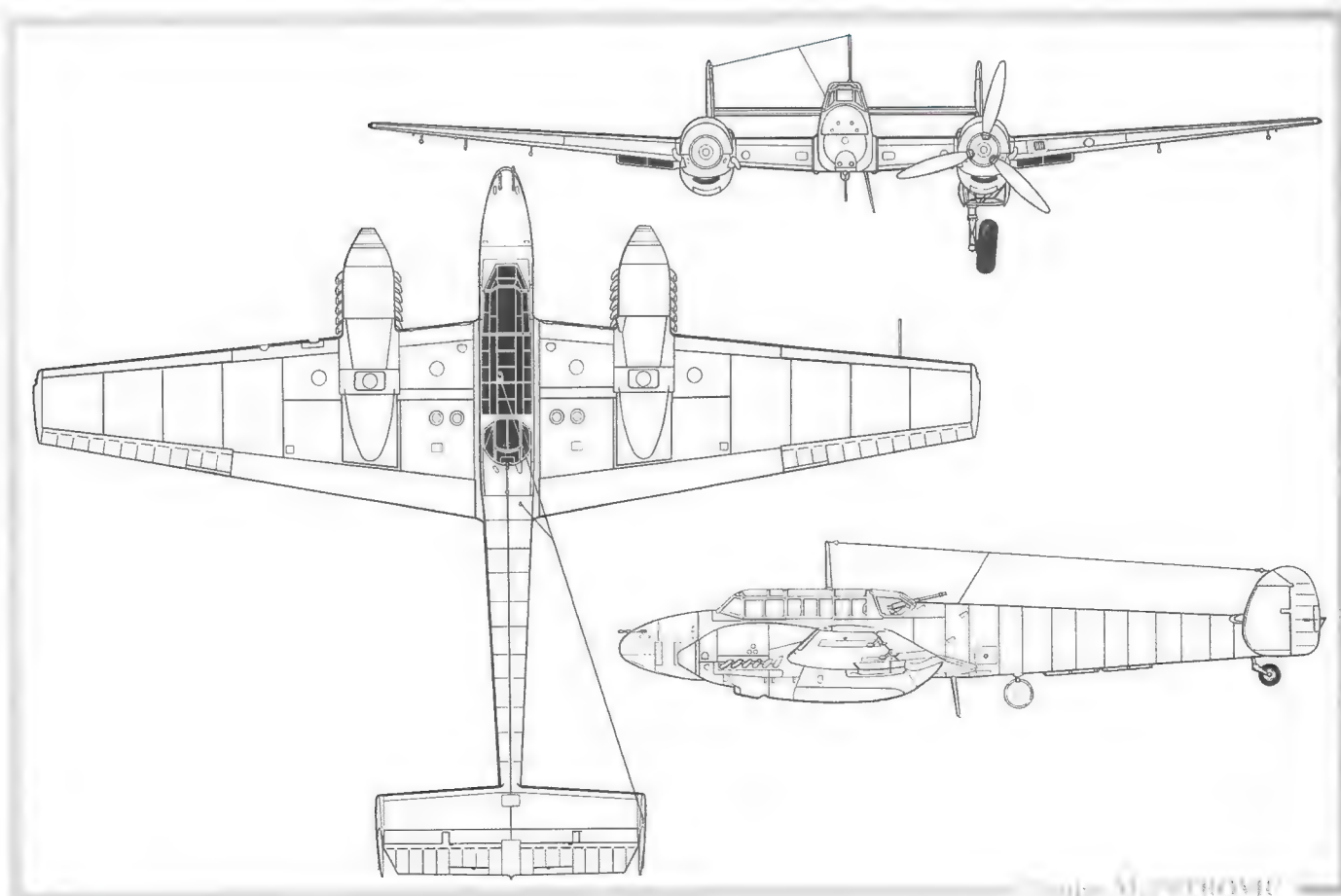
There is no confirmation of the insignia location of the same, however, according to witnesses, it is likely that "Kosovo cross" was applied below the starboard and on top of the port wing. Additionally, to differentiate the aircraft from *Luftwaffe* Bf 110s, the entire rudder could have been painted in the colours of the Yugoslav state flag. According to the memories of a VTZ employee, the aircraft had a *Haifisch* (shark mouth) on its nose.

Camouflage scheme

According to the available information, the aircraft was painted in the standard Yugoslav three tone camouflage at VTZ Kraljevo consisting of Dark Ochre, Dark Green and Dark Brown. Camouflage patches were similar to those on Do-17K bombers. The undersides likely remained in the *Hellblau* RLM 65 colour.

| Aircraft Characteristics Messerschmitt Bf 110C-4 (VV Me-110) | |
|--|--|
| Quantity used: | 1 |
| Crew: | 2 or 3 |
| Years of service: | 1941 |
| Span: | 16.3 m (53.3 ft) |
| Length: | 12.1 m (39.6 ft) |
| Height: | 4.1 m (13.5 ft) |
| Wing area: | 38.4 m ² (413 ft ²) |
| Engine: | One 1,100 mhp (1,085 hp) Daimler Benz DB.601A-1 |
| Empty weight: | 5,107 kg (11,259 lb) |
| Loaded weight: | 6,250 kg (13,779 lb) |
| Maximum speed: | 562 km/h (349 mph) at 7,000 m (22,966 ft) 473 km/h (294 mph) at sea level |
| Cruising speed: | 484 km/h (301 mph) at 7,000 m (22,966 ft) 423 km/h (263 mph) at sea level |
| Service ceiling: | 10,000 m (32,808 ft) |
| Initial rate of climb: | 11,2 m/s (36.6 ft/s) |
| Range: | 910 km (565 ml) with 484 km/h at 7,000 m |
| Armament: | Four fixed forward-firing 7.92 mm Rheinmetall-Borsig MG.17 machine guns and two fixed 20 mm Oerlikon FF/M in the nose, and one flexible 7.92 mm Rheinmetall-Borsig MG.15 machine gun in rear cockpit |

Three views of Messerschmitt Bf 110C-4 Zerstörer (O.M. Petrović)



Appendices

Appendix 1. Yugoslav Aviation Ranks

| VV | | Luftwaffe | | Royal Air Force | |
|---------------------------------------|---------------|-------------------------|-----------|---|-------|
| rank | abb. | rank | abb. | rank | abb. |
| <i>armijski đeneral</i> | arm đen | <i>General Oberst</i> | GenOb. | Air Chief Marshall | ACM |
| <i>divizijski đeneral</i> | div đen | <i>General Leutnant</i> | GenLt. | Air Marshall | AM |
| <i>vazduhoplovni brigadni đeneral</i> | vazd brig đen | <i>General Major</i> | GenMaj. | Air Vice Marshall | AVM |
| <i>pukovnik</i> | puk | <i>Oberst</i> | Oberst | Group Captain | G/Cpt |
| <i>potpukovnik</i> | ppuk | <i>Oberstleutnant</i> | OberstLt. | Wing Commander | W/Cdr |
| <i>major</i> | maj | <i>Major</i> | Maj. | Squadron Leader | S/Ldr |
| <i>kapetan I klase</i> | kap Ik | <i>Hauptmann</i> | Hptm. | Flight Lieutenant 1 st class | F/Lt |
| <i>kapetan II klase</i> | kap IIk | - | - | - | - |
| <i>poručnik</i> | por | <i>Oberleutnant</i> | Oblt. | Flying-Officer | F/O |
| <i>potporučnik</i> | ppor | <i>Leutnant</i> | Lt. | Pilot-Officer | P/O |
| <i>narednik-vodnik I klase</i> | nv Ik | <i>Stabsfeldwebel</i> | Stfw. | Flight Sergeant | F/sgt |
| <i>narednik-vodnik II klase</i> | nv IIk | <i>Oberfähnrich</i> | Obfhr. | - | - |
| <i>narednik-vodnik III klase</i> | nv IIIk | <i>Oberfeldwebel</i> | Obfw. | - | - |
| <i>narednik I klase</i> | nar Ik | <i>Feldwebel</i> | Fw. | Sergeant | Sgt |
| <i>narednik II klase</i> | nar IIk | <i>Unterfeldwebel</i> | Ufw. | - | - |
| <i>podnarednik I klase</i> | pnar Ik | <i>Unteroffizier</i> | Uffz. | Corporal | Cpl |
| <i>podnarednik II klase</i> | pnar IIk | <i>Stabsgefreiter</i> | Stgefr. | Senior Aircraftman | SAC |
| <i>kaplar</i> | kpl | <i>Gefreiter</i> | Gefr. | Airman 1 st Class | A1C |
| <i>redov</i> | red | <i>Flieger</i> | Flg. | Airman 2 nd Class | A2C |

According to VV service rule, non-commissioned officers which met the requirements for officer rank without completing the Military Academy were entitiled rank of vojno-tehnički činovnik of various classes which were equivalent to specific officer ranks:

| | | |
|--|-----------|-------------------------|
| <i>viši vojnotehnički činovnik I klase</i> | vvtč Ik | <i>brigadni đeneral</i> |
| <i>viši vojnotehnički činovnik II klase</i> | vvtč IIk | <i>pukovnik</i> |
| <i>viši vojnotehnički činovnik III klase</i> | vvtč IIIk | <i>potpukovnik</i> |
| <i>viši vojnotehnički činovnik IV klase</i> | vvtč IVk | <i>major</i> |
| <i>niži vojnotehnički činovnik I klase</i> | nvtč Ik | <i>kapetan I klase</i> |
| <i>niži vojnotehnički činovnik II klase</i> | nvtč IIk | <i>kapetan II klase</i> |
| <i>niži vojnotehnički činovnik III klase</i> | nvtč IIIk | <i>poručnik</i> |
| <i>niži vojnotehnički činovnik IV klase</i> | nvtč IVk | <i>potporučnik</i> |

Appendix 2. VV unit structures

| | |
|--|--|
| <i>brigada</i> (Brigade) | Comprised of two to three Bomber or Fighter Regiments |
| <i>puk</i> (Regiment) | Composed of two to three fighter or two bomber Aviation Groups |
| <i>grupa</i> (Group) | A tactical unit consisting of two to three <i>Escadrilles</i> |
| <i>eskadrila</i> (<i>Escadrille</i>) | A unit consisting of nine to 12 aircraft |

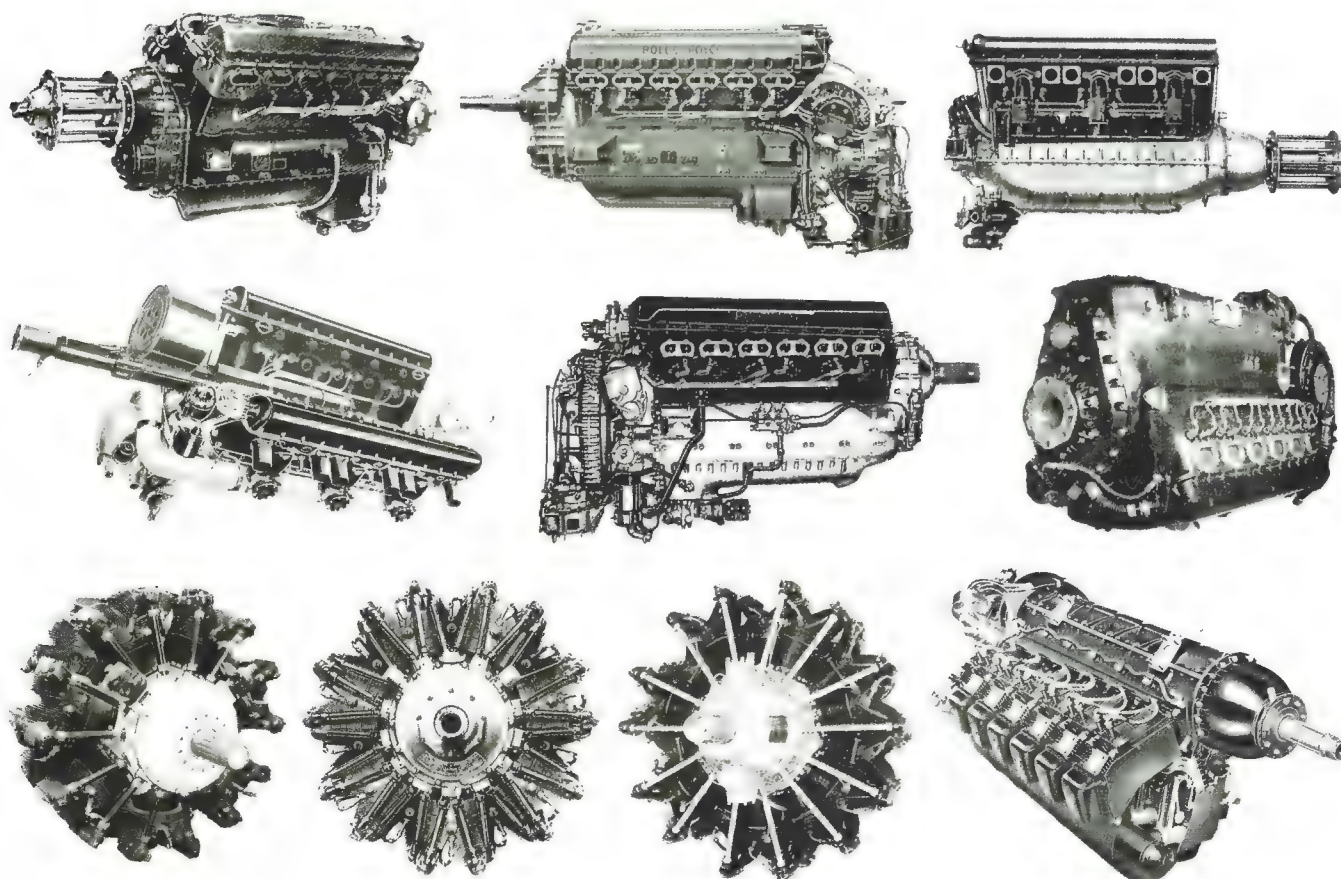
Appendix 3. Abbreviations

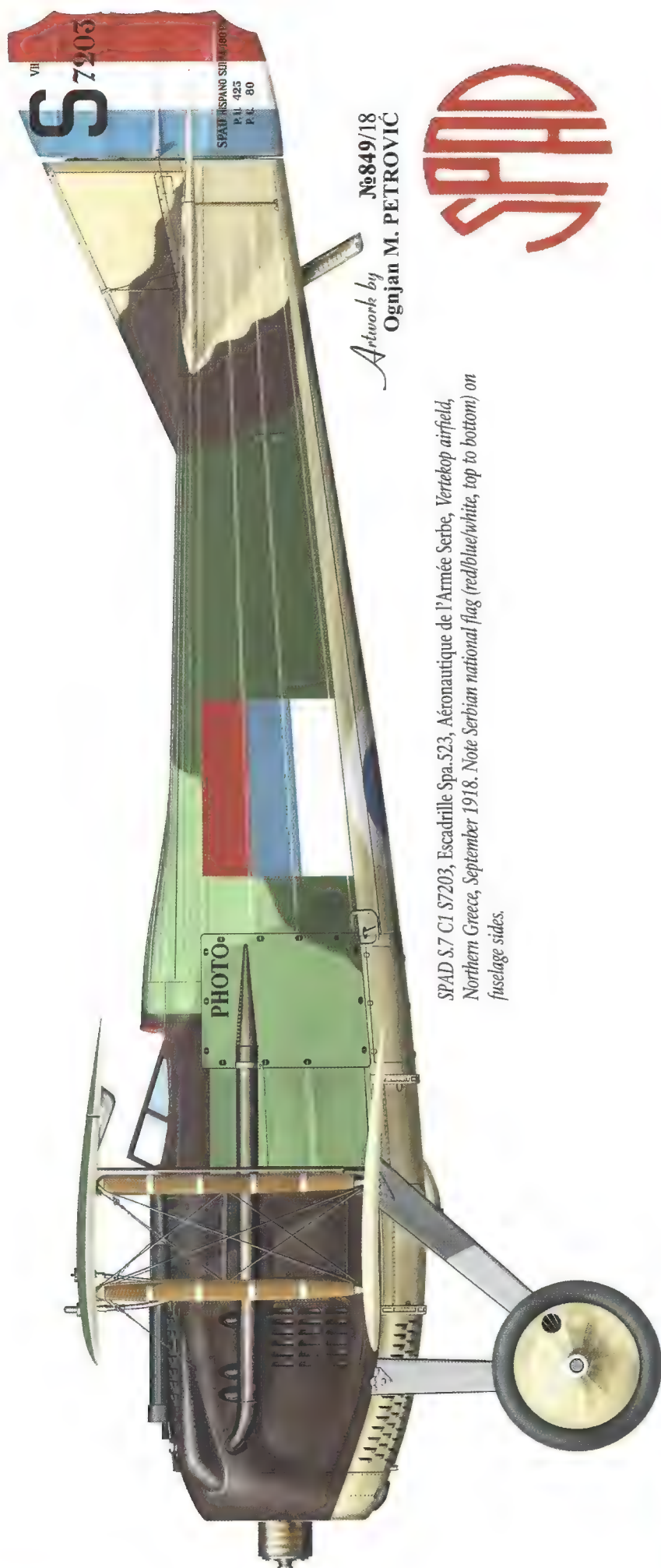
| | | |
|--|------|---|
| <i>auslandisch</i> | a | Foreign |
| <i>противавионска, 'и</i> | AA | Anti Aircraft |
| <i>Аеродромска чета</i> | AČ | Airfield Company |
| <i>Акционарско Друштво</i> | AD | Joint Stock Company |
| <i>Аеропланска радионица</i> | AR | Aeroplane Workshop |
| <i>Армијско ваздухопловство</i> | AV | Army Aviation |
| <i>Број</i> | Br | Number |
| <i>Бомбардерски пук</i> | BP | Bomber Regiment |
| <i>cheval vapeur (French power unit)</i> | CH | Equal to 7 kg/s, i.e. 735.3 watts |
| - | c/n | Construction number |
| <i>Centre de Réception des Avions de Serie</i> | CRAS | Center for Series Aircraft Reception |
| <i>динар</i> | D | Dinar, Yugoslav Dinar (money currency) |
| <i>Ескадрила</i> | E | <i>Escadrille</i> |
| <i>Ελληνική Βασική Αεροπορία</i> | EVA | Royal Hellenic Air Force |
| <i>Фабрика авиона Краљево</i> | FAK | Aircraft Factory Kraljevo |
| <i>Forțele Aeriene Regale ale României</i> | FARR | Royal Romanian Air Force |
| - | HQ | Headquarters |
| <i>Horse power (Imperial power unit)</i> | hp | Equal to 33,000 lbs ft/min i.e. 745.7 watts |
| <i>Индустрија аеропланских мотора</i> | IAM | Aero Engines Industry |
| <i>Извиђачка група</i> | IG | Reconnaissance Group |
| <i>Југословенско ратно ваздухопловство</i> | JRV | Yugoslav Air Force |
| <i>Коњска снага (Serbian power unit)</i> | KS | Equal to 7 kg/s, i.e. 735.3 watts |
| <i>Краљевина Југославија</i> | KJ | Kingdom of Yugoslavia |
| <i>Команда Ваздухопловства</i> | KV | Air Force Command |
| <i>Ловац</i> | L | Fighter |
| <i>Ловачка бригада</i> | LB | Fighter Brigade |
| <i>Ловачка ескадрила</i> | LE | Fighter <i>Escadrille</i> |
| <i>Ловачка пилотска школа</i> | LPŠ | Fighter Pilot School |
| <i>Ловачки пук</i> | LP | Fighter Regiment |
| <i>Ловац ваздухопловно-технички</i> | LVT | Fighter Aviation-Technical |
| <i>Министарство Војске и Морнарице</i> | MViM | Ministry of War and Marine |
| <i>metric horse power (power unit)</i> | mhp | Equal to 7 kg/s, i.e. 735.3 W |
| <i>numera, broj</i> | № | Numero, Number |
| <i>Nezavisna Država Hrvatska</i> | NDH | Independent State of Croatia |
| <i>Пилотска школа</i> | PS | Pilot School |
| <i>Поморско ваздухопловство</i> | PV | Naval Air Service |
| <i>Regia Aeronautica</i> | RA | Royal Italian Air Force |
| - | RAF | Royal Air Force |
| <i>Резервни</i> | rez | Reserve |
| - | RYAF | Royal Yugoslav Air Force (i.e. VV) |

| | | |
|--|------|---|
| - | s/n | Serial number |
| <i>Štab Vazduhoplovstva vojske</i> | ŠVV | Air Force HQ |
| <i>Технички парк</i> | TP | Technical Park |
| - | UK | United Kingdom |
| <i>Versuch</i> | V | Trial |
| <i>Ваздухопловство</i> | V | Air Force |
| <i>Ваздухопловна база</i> | VB | Airbase |
| <i>Ваздухопловна група</i> | VG | Aviation Group |
| <i>Ваздухопловна извиђачка група</i> | VIG | Aviation Reconnaissance Group |
| <i>Ваздухопловна команда</i> | VK | Air Force Command |
| <i>Ваздухопловна опитна група</i> | VOG | Air Test Group |
| <i>Ваздухопловни пук</i> | VP | Aviation Regiment |
| <i>Ваздухопловни савез Југославије</i> | VSJ | Aeronautical Union of Yugoslavia |
| <i>Ваздухопловно-технички парк</i> | VTP | Aviation Technical Park |
| <i>Ваздухопловно-технички завод</i> | VTZ | Aviation Technical Depot |
| <i>Ваздухопловство војске</i> | VV | Army Air Force |
| <i>Војно евиденцијски број</i> | EvBr | Army (or Military) Evidence Number – RYAF serial number |
| <i>Werke Nummer</i> | WNr. | Construction number |
| <i>Zrakoplovstvo Nezavisne Države Hrvatske</i> | ZNDH | Independent State of Croatia Air Force |

Appendix 4. Aero Engines

Aero engines used by VV fighters after 1931: (from left to right, top row) Rolls-Royce Kestrel IIS, Rolls-Royce Kestrel XVIIS, Hispano-Suiza 12Nb; (mid) Hispano-Suiza 12Y, Rolls-Royce Merlin II, Daimler-Benz DB.601A; (bottom) Hispano-Suiza 14Ab, Gnome-Rhone 14M Mars, FIAT A.74 RC.38, Walter "Sagita" IIR (manufacturer publications)





SPAD S.7 C1 S7203, Escadrille Spa.523, Aéronautique de l'Armée Serbe, Vertekop airfield, Northern Greece, September 1918. Note Serbian national flag (red/blue/white, top to bottom) on fuselage sides.

Artwork by
Ognjan M. PETROVIĆ
№849/18

SPAD

Errata Vol.1

- p.11, note under the table: 6.LP instead of 6.VP.
- p.38: side profile has an error in the flag colour. The red and the blue colours are reversed.
- p.88: in the Service in the Kingdom chapter, first paragraph, row 4 should say 12 and 13 October instead of 18 October.
- p.90: photograph signature in the last row – should say Blue instead of Red.
- p.96: table is missing the range (570 km) and maximum altitude (6,000 m) as well as the speed of 192 km/hr at 2,000m.
- p.101: first paragraph – should say *Chrétien* instead of STAé.
- p.106: below the mid table (for series D.1) the following is missing: For documenting strikes in mock dog fights, aircraft were equipped with one gun camera OPL *photomitrailleuse modèle* 1923 mounted parallel to gun-sight and activated by the machine-gun trigger.
- p.115: all measures in the text for the original sketch were given in mm – not in cm.
- p.122: below Aircraft Characteristics table the following is missing: Gun sight and gun camera were the same as on D.1.
- p.136: Description of the bottom photograph should indicate that nar Djuro Apro is in the photograph.
- p.152: Signature of the middle photograph, 5th row – should say White 142 instead of 12.
- p.182: Aviatik Berg table contains series 338 which should be removed.
- p.183: S.N.C.A.N. Potez 630 C3 table, the first row, the fifth (Note) column: Note should be “P.630 C3 No1Y (double command)” instead of all text in the field.
- p.185: Appendix 7. – remove word Escadre from AE abbreviation. Should remain Aero-plane Escadrille.
- p.189: the following title is missing: Cooksley, Peter, *Bristol Fighter in Action* (Aircraft No 137, Squadron/Signal Publications, Carrollton, TX, USA, 1993).
- p.189: Dušan Ćirović's book title should list 1913–1945 instead of 1931–1945.
- p.190: first book title in Cyrillic should list 1924–1944 instead of 1918–1924.
- p.191: under Periodicals, *Naše nebo i naše more* – publication years should be 1926–1928 instead of 1926–1938.
- p.191: under Periodicals, *Naše nebo* – publication years should be 1929 instead of 1927–1930.



Artwork by
Ognjan M. PETROVIĆ

Nº1033/20

B.X. 33 2005

Enlarged factory applied newly introduced
fuselage inscription.

Ikarus-built Avia BH-33 EvBr 2005 "White 28",
3rd Pilot School, VV, April 1941.



"White 28", without machine-guns and
gunsight, pictured at auxiliary war airfield
Kapino Polje near Nikšić, after it was captured
by the Italians. This machine carried new style
of inscription on fuselage side as combination of
aircraft type and Evbr (B.H.33 2005) and stand-
ardized serial number in No form (Nº2005).
(Achille Vigna via Šime Oštrić)

New style of rudder inscriptions with new EvBr and small Ikarus logo.



Artwork by
Ognjan M. PETROVIĆ

№269/93



Artwork by
Ognjan M. PETROVIĆ

№312/93



Artwork by
Ognjan M. PETROVIĆ

№487/08

Three in action images of VV fighters: (top to bottom)
Ikarus IK-2 №2104, Rogožarski IK-3 EvBr 2154,
Messerschmitt Me-109 EvBr 2513/L-13.

Bibliography

Selected Bibliography:

- 70 godina vazduhoplovne industrije Jugoslavije 1923-1993 (Organizacioni odbor za obeležavanje 70 godina vazduhoplovne industrije Jugoslavije (Beograd, Yugoslavia, 1993)
- Album silueta naših aviona i hidroaviona sa pregledom oznaka aviona i hidroaviona pojedinih država* (Албум ситуета наших авиона и хидроавиона са прегледом ознака авиона и хидроавиона појединих држава) (Beograd, Kingdom of Yugoslavia, 1940)
- Aprilski rat 1941, Zbornik dokumenata, Knjiga 1* (Vojnoistorijski institut, Beograd, Yugoslavia, 1969); *Knjiga 2* (Vojnoistorijski institut, Beograd, Yugoslavia, 1987)
- „Evidencija izvršenih letova Ikarusa 1931-1951” („Евиденција извршених летова Икаруса 1931-1951”, књига летова „Икаруса“) (Muzej vazduhoplovstva (MV), Beograd, Serbia)
- Fighters A to Z* (Air International, UK, August 1993)
- Hawker Hurricane* (Aerodata International No 5, Oxford, England, 1978)
- Hurricane from Zemun, Plane Facts* (Air Enthusiast Vol 3 No 3, UK, March 1972)
- ME 109, Messerschmitt Bf 109E* (Aeroguide Classics No 2, Linewrights Ltd, Essex, UK, 1986)
- Jagdeinsitzer Hawker “Hurricane”* (“Flugsport” Nr. 11/1938, Bd.30, Germany, p. 291-294)
- Multi-purpose “Dragon”, Plane Facts* (Air International, Vol 4, No 6, UK, June 1973)
- Tehnički opis i uput za avione Meseršmit Me-109 sa motorom Dajmлер-Benz DB-601* (Технички опис и упут за авионе МЕСЕРШМИТ Ме-109 са мотором Дажмлер-Бенц ДБ-601) (Štab Vazduhoplovstva vojske, Zemun, Kingdom of Yugoslavia, 1940)
- The Yugoslav Mosquito, Plane Facts* (Air Enthusiast Vol 1 No 2, UK, July 1971)
- Ajdič, Gustav, *Me 110 ni opravil svoje naloge* (Krila 2/77, Ljubljana, Yugoslavia, 1977)
- Ajdič, Gustav, *Smer Imotski...* (Krila 5/83, Ljubljana, Yugoslavia, 1983).
- Ajdič, Gustav, Jerin, Zoran, *Letalstvo in Slovenci 2, od prve do druge svetovne vojne* (Založba Borec – Mladika, Ljubljana, Yugoslavia, 1990)
- Aleksić, Dragan (Драган Алексић), Djokić, Nebojša (Небојша Ђокић), *Francuski vazduhoplovi u naoružanju vojske i mornarice Kraljevine Jugoslavije* (Француски ваздухоплови у наоружању војске и морнарице Краљевине Југославије) (INIS, Beograd, Serbia, 2008)
- Angelucci, Enzo, Matricardi, Paolo, *Guida pratica agli aeroplani du tutto il mondo II° dal 1919 al 1935* (Arnoldo Mondadori Editore, Italy, 1976)
- Angelucci, Enzo, Matricardi, Paolo, *Guida pratica agli aeroplani du tutto il mondo III° la seconda Guerra mondiale – parte prima* (Arnoldo Mondadori Editore, Italy, 1977)
- Apostolo, Giorgio, Bignozzi, Giorgio, *Profili di aerei militari dal 1919 al 1939* (Fratelli Fabbri Editori, Milano, Italy, 1974)
- Apostolo, Giorgio, Bignozzi, Giorgio, *Profili di aerei militari della 2a guerra Mondiale*, (Fratelli Fabbri Editori, Milano, Italy, 1977)
- Aralica, Tomislav, Aralica, Višeslav, *Hrvatski ratnici kroz stoljeća, 2. knjiga, Razdoblje Kraljevine SHS/Jugoslavije 1918. – 1941.* (Znanje d.d., Zagreb, Croatia, 2006)
- Aralica, Tomislav, Čopce, Robert, Jeras, Marko, Kinjerovac, Zdenko, Haraminčić, Tomislav, *Sto godina ratnog zrakoplovstva u Hrvatskoj* (Despot Infinitus d.o.o., Zagreb, Croatia, 2012)
- Avramovski, Živko, *Britanci o Kraljevini Jugoslaviji 2 (1931-1938)* (Arhiv Jugoslavije Beograd / Globus Zagreb, Yugoslavia, 1986); *3 (1939-1941)* (Arhiv Jugoslavije Beograd / Jugoslovenska knjiga Beograd, Yugoslavia, 1996)
- Bączkowski, Wiesław, Chołoniewski, Krzysztof, *Samoloty nad Półwyspem Bałkańskim 1940-1941, Część I, Część II* (Barwa w lotnictwie świata, WKŁ, Warszawa, Poland, 1990, 1991)

- Balous, Miroslav, *Potez (SNCAN) 630 a 631*, (L + K 7/90, Praha, ČSR)
- Beaman, John, R., Jr., Campbell, Jerry, L., *Messerschmitt Bf 109 in Action, Part 1, Aircraft No. 44* (Squadron Signal publications, Carrollton, USA, 1980)
- Bishop, Eduard, *Hurricane* (Airlife, UK, 1986)
- Bišćević, Ing Adem (Адем Бишћевић), *Bombarderski avioni i stanje njihove izrade kod nas* (Бомбардерски авиони и стање њихове израде код нас) (Vazduhoplovni glasnik br. 5, Beograd, Kingdom of Yugoslavia, May 1938, p. 61-86)
- Bjelajac, Mile, *Vojska Kraljevine Srba, Hrvata i Slovenaca / Jugoslavije 1922-1935* (INIS, Beograd, Yugoslavia, 1994)
- Boljević, Arsenije (Бољевић, Арсеније), *Jugoslovensko vazduhoplovstvo u ratu aprila 1941* (Југословенско ваздухопловство у рату априла 1941) (Vojno delo br. 1 (Војно дело бр. 1), Beograd, Yugoslavia, 1952)
- Bosnić, Petar (Петар Боснић), *Nabavka lovaca Me-109E* (Набавка ловаца Ме-109Е), (Let 1, Muzej Jugoslovenskog vazduhoplovstva (MJV), Beograd, Yugoslavia, 1998, p. 150-173)
- Bosnić, Petar, „Hokeri“ na braniku otadžbine (Aero magazin 72, Beograd, Serbia, June/July 2006, p. 30-33)
- Bosnić, Petar, *Operacija Šiler - rat špijuna za IK-3* (Aero magazin 12, Beograd, Yugoslavia, November 1999, p. 32-34)
- Bosnić, Petar, *Orkan iz Ikarusa* (Aero magazin 10, Beograd, Yugoslavia, September 1999, p. 30-32)
- Bosnić, Petar (Петар Боснић), *IK-3 u nemačkim rukama, Misterija rešena posle 60 godina traganja* (ИК-3 у немачким рукама, Мистерија решена после 60 година трагања) (Naša krila 37, Beograd, Serbia and Montenegro, April 2003, p. 7-8)
- Bosnić, Petar (Петар Боснић), *Ponovo o Harikenu, Sudbina poslednjih domaćih Harikena* (Поново о Харикену, Судбина последњих домаћих Харикена) (Naša krila 34, Beograd, Serbia and Montenegro, March 2001, p. 5)
- Bosnić, Petar, *Rogožarski IK-3 Belgrade Defender* (unpublished script, Beograd, Serbia and Montenegro, 2003)
- Brašnović, Dragiša, *Emil's over Yugoslavia* (Scale Models International, Vol 15 No 178, UK, August 1984)
- Campbell, Jerry L., *Messerschmitt Bf-110 Zerstörer in action* (Squadron/Signal Publications, Carrollton, USA, 1977)
- Caruana, Richard, J., *Born with Sting, The Hawker Fury* (Scale Aircraft Modelling International Vol 3 Issue 8, UK, August 1997)
- Ciglić, Boris, „Bruderkampf“ über dem Balkan (Flugzeug Classic 9/2016, München, Germany, 2016)
- Ciglić, Boris with Savić, Dragan, Micevski, Milan & Miladinović, Predrag, *Messerschmitt Bf 109 - The Yugoslav story, Operational Record 1939-1953, Volume I* (Jeroplan Books, Beograd, Serbia, 2016)
- Citterio, Piergorgio, *Hawker Hurricane* (Aerei N.3, Italy, Marzo 1984, p. 18-26)
- Cox, G. A. G., *Famous Biplanes No. 23 Hawker Fury* (Aero Modeller Vol. 24 No 287, UK, December 1959)
- Craig, James F., *The Messerschmitt Bf-109* (Famous aircraft series, Aero Publishing Company, New York, USA, 1968)
- Crawford, Alex, *Hawker Fury & Nimrod* (Mushroom Model Publications/Stratus, UK/Polland, 2007)
- Cvijetić, Dr Leposava, *Prodaja naoružanja kao metod ekonomskog i političkog pritiska nacističke Nemačke na Jugoslaviju* (Istorija XX veka, Zbornik radova XIII, ISI, Beograd, Yugoslavia, 1975)
- Ćirović, Dušan (Душан Ћировић), *Vazduhoplovne žrtve 1931-1945* (Ваздухопловне жртве 1913-1945) (Author's publication, Zemun, Yugoslavia, 1970)
- Danel, Raymond, *Potez 63, Aircraft Profile No. 195* (Profile Publications, London, UK, 1967)
- Dimitrijević, Bojan B., Micevski, Milan, Miladinović, Predrag, *Kraljevsko vazduhoplovstvo 1918-1944* (ISI, Beograd, Serbia, 2012)
- Djokić N, Petrović O, *Branili smo se "Harikenima"* (Narodna armija 2710, Beograd, Yugoslavia, 20.6.1991, p. 44)
- Džodžović, Stanislav, *Na krilima - Peti lovački puk 1941. Kumanovo* (Elit, Beograd, Yugoslavia, 1996)
- Fernandez, José, *Potez 63 Family* (MMP/Stratus, Poland, 2008)
- Frka, Danijel, Novak, Josip, Pogačić, Siniša, *Zrakoplovstvo nezavisne države Hrvatske* (p.c. grafičke usluge, Zagreb, Croatia, 1998)
- Garello, Giancarlo, *I rapporti aeronautici italo-iugoslavi nel periodo 1938-1943 - Parte III, Le prede belliche* (Aerei N.7/8, Italy, luglio/agosto 1977)
- Garello, Giancarlo, *Prede di Guerra, Aerei jugoslavi, inglesi, statunitensi, belgi 1940-1943* (La Bancarella Aeronautica – Torino, Italy, 2007)
- Givkovitch, Radmio P., *L'Aéronautique Yougoslave* (Minerva, Beograd, Kingdom of Yugoslavia, 1935)
- Gončin, Milorad, *Ustaški avion kratko je leteo* („4. jul“, br. 334, SUBNOR, Beograd, Yugoslavia, 12.XI 1968, p. 6)
- Green, William and Swanborough, Gordon, *RAF Fighters Part Two* (WW2 Aircraft Fact Files, Macdonald and Jane's, London, UK, 1979)

- Green, William, *Fighters Volume One* (Edition War Planes of the Second World War, Macdonald, London, UK, 1972)
- Green, William, *Fighters Volume Two* (Edition War Planes of the Second World War, Macdonald, London, UK, 1972)
- Green, William, *Fighters Volume Four* (Edition War Planes of the Second World War, Macdonald, London, UK, 1969)
- Grey, C. G., Bridgman, Leonard, *Jane's All the Worlds Aircraft 1938* (Sampson Low, Marston & Co, UK, 1938)
- Gunston, Bill, *The Encyclopedia of the World's Combat Aircraft* (Salamander book, Hamlyn, London, UK, 1976)
- Hall, Allan W., *Barrier-breaking Fury* (Air Enthusiast Three, UK, 1977)
- Hall, Allan W., *Hawker Fury and Nimrod* (Scale Aircraft Modelling, Volume 16 Number 2, UK, December 1993)
- Harrison, William, *Hawker Fury and Nimrod, Warpaint series No. 116* (Warpaints Books Ltd, Buckinghamshire, UK, 2018)
- Hornát, Jiří, *Hawker Hornet a Fury, část II* (L+K 22/97, Praha, ČSR)
- Hrelja, Mario (Марио Хрелја), *Zapisnik aeroplanskog kvara* (Записник аеропланског квара), (Mario Hrelja, Beograd, Serbia, 2020)
- Hrelja, Mario (Марио Хрелја), Dimitrijević, Bojan (Бојан Димитријевић), *April 1941 (Април 1941)* (Naša krila Specijalno izdanje, Beograd, Yugoslavia, April 2001)
- Ishoven, Armand van, *Messerschmitt Bf-109 at War* (Ian Allan, London, UK, 1977)
- J., M., *Zmaj R-1 (Jugoslawien)* (Flugzeug Revue 2/76, DDR, 1976)
- Janić, Č., *Zmaj R-1* (Aerosvet 289, Beograd, Yugoslavia, 15.3.1965)
- Janić, Čedomir, *Avion R-313* (Front 1362, Beograd, Yugoslavia, 31.8.1984, p. 42-44)
- Janić, Čedomir, *Jugoslovenska vazduhoplovna industrija, Chapter in Ilustrovana istorija vazduhoplovstva* (Začetnici avijacije, Beograd, Yugoslavia, 1988)
- Janić, Čedomir, *Lovci IK-1, IK-2 i IK-3, Chapter in Ilustrovana istorija vazduhoplovstva* (Ratna krila, Beograd, Yugoslavia, 1988)
- Janić, Čedomir, *Operacija "Kaznena odmazda", Chapter in Ilustrovana istorija vazduhoplovstva* (Ratnici neba, Beograd, Yugoslavia, 1987)
- Janić, Čedomir, *Orkan* (Front 1374, Beograd, Yugoslavia, 23.11.1984)
- Janić, Čedomir, *Vazdušne borbe nad Jugoslavijom, dejstva lovačke avijacije* (Aero magazin, special edition, Portorož, Yugoslavia, br. 2-3/91, p. 6-16)
- Janić, Čedomir (Чедомир Јанић), Petrović, Ognjan (Огњан Петровић), *Kratka istorija vazduhoplovstva u Srbiji (Кратка историја ваздухопловства у Србији)* (Аерокомуникације, Beograd, Serbia, 2011)
- Janić, Čedomir J. (Чедомир Ј. Јанић), Petrović, Ognjan M. (Огњан М. Петровић), *Tvorci vazduhoplovstva Kraljevine Jugoslavije (Творци ваздухопловства Краљевине Југославије)* (Музеј науке и технике, Beograd, Serbia, 2017)
- Janić, Čedomir (Чедомир Јанић), Petrović Ognjan (Огњан Петровић), *Vek avijacije u Srbiji 1910-2010, 225 značajnih letelica (Век авијације у Србији 1910-2010, 225 значајних летелица)* (Аерокомуникације, Beograd, Serbia, 2010)
- Janić, Čedomir, Petrović, Ognjan, *Short History of Aviation in Serbia* (Аерокомуникације, Belgrade, Serbia, 2011)
- Janowicz, Krzysztof, *Bałkany 1941* (Kampanie Lotnicze 10, AJ-Press, Gdynia, Poland, 1996)
- James, Derek N., *Hawker an aircraft album* (Ian Allan, London, UK, 1972)
- Jerin, Zoran, *Emil versus Luftwaffe* (Air Enthusiast, Vol 1 No 4, UK, September 1971)
- Jovanović, Dragan, *Jugoslávské Messerschmitty 1938-1953* (HPM 4/2003; (pokračování z minulého čísla) 5/2003, Praha, Czech Republic, 2003)
- Juričić, Želimir Bob, *Ivo Andrić u Berlinu* (Sarajevo, Yugoslavia, 1989)
- Juszcak, Artur, Karnas, Dariusz, *Hawker Hurricane* (AJ Press, Gdansk, Poland, 1999)
- Kljakić, Dragan, *Oni su branili Beograd* (August Cesarec, Zagreb, 1980)
- Kolo, Aleksandar, *Na čemu se nekada letelo, Emili nad Jugoslavijom* (Front br. 32 (1149), 1.8.1980, Beograd)
- Kolo, Aleksandar (Александар Коло), Miladinović, Predrag (Предраг Миладиновић), *Vazduhoplovne oznake Kraljevine SHS 1918-1924 (Ваздухопловне ознаке Краљевине СХС 1918-1924)* (Vesnik 37, Belgrade, Serbia, 2010, p. 177-184)
- Kolo, Aleksandar (Александар Коло), Miladinović, Predrag (Предраг Миладиновић), *Vazduhoplovne oznake Kraljevine SHS/Jugoslavije 1924-1944 (Ваздухопловне ознаке Краљевине СХС/Југославије 1924-1944)* (Vesnik 38, Belgrade, Serbia, 2011, p. 117-127)
- Kostić, Božidar (Божидар Костић), *Plamen nad Beogradom (Пламен над Београдом)* (Motiv, Beograd, Yugoslavia, 1991)

- Kowalski, Tomasz, J., *Samolot Myśliwski Messerschmitt Bf 109 A-E* (Typy Broni i uzbrojenia 131, WMO, Warszawa, Poland, 1989)
- Ledet, Michel, *Avril 1941: Hitler attaque la Yougoslavie - Operation Marita* (Batailles Aeriennes No 14, Lela Presse, Boulogne sur Mer, France, 2000)
- Ledwoch, Janusz, Skupiewski, Adam, *Messerschmitt Bf 109, 1* (AJ Press, Gdansk, Poland, 1992)
- Likso, Tihomir, Čanak, Danko, *Hrvatsko ratno zrakoplovstvo u drugome svjetskom ratu, The Croatian Air Force in World War Two* (Danko Čanak, Nova Gradiška, Croatia, 1998)
- Lluch, José Miguel Sales, Vieira, Ruy Aballe, *Hawker Fury* (Vol. 1) (La Maquina y la Historia, Perfiles Aeronauticos 10, Quiron Ediciones, Valladolid, Spain, 2005)
- Lučić, Dušan, D. (Луčić Д. Душан), Živić, Mihajlo, T. (Михајло Т. Живић), *Poznavanje aviona (Познавање авиона)* (Štab Vazduhoplovstva vojske, Zemun, Kingdom of Yugoslavia, 1940)
- Lumsden, Alec, Thetford, Owen, *On Silver Wings* (Osprey, Oxford, UK, 1993)
- MacKay, Ron, *Hawker Hurricane Walk Around No. 14* (Squadron/Signal Publications, Carrolton, USA, 1998)
- Marchand, Patrick, Takamori, Junko, *Les Potez 63* (Les AILES de GLOIRE № 9, Le Muy, France, 2002)
- Maruško, Mitja, *Hawker Fury, 1. del* (Krila 6/90 Ljubljana, Yugoslavia, 1990); *2. del* (Krila 1/91, Ljubljana, Yugoslavia, 1991)
- Mason, Francis, K., *The Hawker Fury, Aircraft Profile No. 18* (Profile Publications, London, UK, 1965)
- Mason, Francis, K., *The Hawker Hurricane I, Aircraft Profile No. 111* (Profile Publications, London, UK, 1966)
- Mason, Francis K., *The Hawker Hurricane* (The Royal Air Force Museum Edition, Aston Publications, UK, 1990)
- Micevski, Milan, *Pod tuđim zastavama* (Aero magazin, special edition, Portorož, Yugoslavia, br. 2-3/91, p. 36-40)
- Michulec, Robert, *Messerschmitt Bf 109, 1. část* (AJ Press, Gdynia, Poland, 1998)
- Mihalački, Branislav J. (Бранислав Ј. Михалачки), *Prva međunarodna vazduhoplovna izložba u Beogradu 1938. god* (Прва међународна ваздухопловна изложба у Београду 1938. год) (Štab Vazduhoplovstva vojske (ŠVV), Zemun, Kingdom of Yugoslavia, 1939)
- Mijatović, Mr Ivan, Djokić, Mr Nebojša, *Lovačka avijacija Kraljevine Jugoslavije i praćenje savremenih trendova u naoružanju* (Ловачка авијација Краљевине Југославије и праћење савремених трендова у наоружању) (Rasinski anali 9, Istorijski arhiv Kruševac, Serbia, 2011, p. 135-168)
- Mikić, Sava (Сава Микић), *Istorija Jugoslovenskog vazduhoplovstva* (Историја Југословенског ваздухопловства) (Beograd, Kingdom of Yugoslavia, 1932)
- Miklušev, Nenad, *Lovački avioni IK Fighters, Special, Ikarus & Rogožarski IK-L1, IK-2, IK-3, IK-4, IK-5, S-49A, S-49C* (Model Art broj 6/YASIG Newsletter March, Zrenjanin, Yugoslavia, 1998)
- Miklušev, Nenad, *Potez 630/631 u bojama J.K.R.V.* (Model Art br. 7, Zrenjanin, Yugoslavia, April 1998)
- Miklušev, Nenad, *Rogožarski IK-2* (YASIG Publications, Novi Sad, Serbia, 2006)
- Miklušev, Nenad, *Rogožarski IK-3* (YASIG Publications, Novi Sad, Serbia, 2006)
- Miklušev, Nenad, Nikolić, Djordje, *Rogožarski IK-3* (Kagero Publishing, Lublin, Poland, 2018)
- Miladinović, Predrag (Предраг Миладиновић), *Gubici osovinske avijacije u vazduhoplovnom ratu protiv Kraljevine Jugoslavije aprila 1941* (Губици осовинске авијације у ваздухопловном рату против Краљевине Југославије априла 1941) (Rasinski anali 1, Istorijski arhiv Kruševac, Serbia and Montenegro, 2003, p. 133-164)
- Miladinović, Predrag (Предраг Миладиновић), *Rekonstrukcija registra jugoslovenskih lovaca Me-109E* (Реконструкција регистра југословенских ловаца Ме-109Е) (Let br. 1/1998, Beograd, Yugoslavia, p. 169-173)
- Milutinović, Sima L. (Сима Л. Милутиновић), *Dvomotorni aeroplan bombarder "R-313"* (Двомоторни аероплан бомбардер „Р-313“) (Saopštenje Mašinske i Vazduhoplovne grupe Tehničkog fakulteta u Beogradu br. 1, Kingdom of Yugoslavia, July 1940, p. 21-22)
- Mombeek, Erik, Roba, Jean-Louis & Pegg, Martin, *Jagdwaaffe, Strike in the Balkans, April-May 1941, Luftwaaffe colours, Volume Three Section 1* (Ian Allan, Hersham, Surrey, UK, 2002)
- Munson, Kenneth, *Fighters between the wars 1919-39* (Blandford Press, Poole Dorset, UK, 1977)
- Munson, Kenneth, *Fighters 1939-45, Attack and Training Aircraft* (Blandford Press, Poole Dorset, UK, 1975)
- Munson, Kenneth, *Planemakers from Picardy* (Wings Volume 7, part 95, UK, 1978)
- Napier, Sid, *Balkan Furies* (Mushroom Model Magazine Vol 3 No 4, UK, 1999)
- Napier, Sid, *The Yugoslav Emils* (Small Air Forces Observer (SAFO) vol 22 no 4 (88), USA, December 1998)
- Napier, Sid, *The Yugoslav Furies* (Small Air Forces Observer (SAFO) vol 22 no 2 (86), USA, July 1998)
- Napier, Sid, *Yugoslav Hurricanes* (Mushroom Model Magazine Vol 4 No 2, UK, 1999)
- Němeček, Václav, *Ikarus Orkan* (L + K 24/88, Praha, ČSR)
- Němeček, Václav, *Rogožarski R-313* (L + K 6/79, Praha, ČSR)
- Němeček, Václav, *Zmaj R-1* (L + K 4/83, Praha, ČSR)

- Nowarra, H. J., *Die Deutsche Luft Rüstung 1933-1945, Messerschmitt Bf 109, Band 3* (Bernard Graefe Verlag, Koblenz, Germany, 1993)
- Nowarra, Heinz, J., *Messerschmitt Bf 109, Aircraft & Legend* (Haynes, Somerset, UK, 1989)
- Ognjević, Aleksandar (Александар Огњевић), *31. vazduhoplovna grupa 2. Iovačkog puka Vazduhoplovstva vojske Kraljevine Jugoslavije u Aprilskom ratu 1941. godine* (31. ваздухопловна група 2. ловачког пука Ваздухопловства војске Краљевине Југославије у Априлском рату 1941. године) (Zapisi, The Historical Archives of Požarevac, No 6, Požarevac, Serbia, 2017, p. 150-168)
- Ognjević, Aleksander et Petrović, Ognjan M., *Le Hawker Fury dans les Balkans, Première partie*, (Avions #210 Mars-avril 2016, p. 74-88); *Seconde et dernière partie* (#211 Mai-juin 2016, p. 52-65)
- Ognjević, Aleksandar, M., *Hawker Hurricane, Fury & Hind, The Yugoslav Story, Operational Record 1931-1941* (LeadenSky Books, Beograd, Serbia, 2019)
- Ognjević, Aleksandar M. (Александар М. Огњевић), *Ratni Dnevnik - Knjiga 1* (Ратни дневник – Књига 1) (Ledensky Books, Beograd, Serbia 2016)
- Ognjević, Aleksandar, M., Mirkov, Branislav, J., *Ikanus IK-2* (Monographs Special Edition in 3D No 13, Kagero, Lublin, Poland, 2019)
- Oštrić, Š., *Ikarusova krila* (Avio revija 9, Beograd, Yugoslavia, May 1983)
- Oštrić, Šime, *Hokerova oluja* (Front 1016, Beograd, Yugoslavia, 20.1.1977)
- Oštrić, Šime I., and Janić, Čedomir J., *IK Fighters (Yugoslavia: 1930-40s), Profile No242* (Profile Publications, London UK, 1972)
- Oštrić, Šime I. (Шиме И. Оштрић), *Hoker Hariken, mirnodopska upotreba u vazduhoplovstvu vojske Kraljevine Jugoslavije* (Хокер Харикен, мирнодопска употреба у ваздухопловству војске Краљевине Југославије) (Naša krila 33, Beograd, Yugoslavia, September 2000, p. 7-10)
- Oštrić, Šime I. (Шиме И. Оштрић), *Uzburkano nebo* (Узбуркано небо) (Nova krila br. 31, Republic Srpska, May 1996)
- Oštrić, Šime, I., *Zenit dvokrilca* (Front 804, Beograd, Yugoslavia, 28.12.1973)
- Oštrić, Šime, drawings Petrović, Ognjan, *Hariken Br. 2337* (Aeroplan broj 2, OLC Sečovlje, Yugoslavia, March-April 1990, p. 16-18, 23-27)
- Oštrić, Šime, *Razarač Potez 63* (Naša krila 16, Beograd, Yugoslavia, December 1997)
- Oštrić, Š., Miladinović, P., drawings Petrović, O., *Meseršmit Bf-109E I deo* (YUAM Aeroplan 6, OLC Sečovlje, November-December 1989, p. 21-29); *Meseršmit Me-109E II deo* (Aeroplan 2, OLC Sečovlje, Yugoslavia, March-April 1990, p. 4-15)
- Oštrić, Šime, *Les Messerschmits Yougoslaves* (Hors Serie No 26, LELA Presse, Outreau, France, 2009)
- Pavlović, Andrija, *Komandni kadar operativnog i armijskog vazduhoplovstva u Aprilskom ratu 1941. godine* (Vazduhoplovni glasnik No361, London, UK, December 1991, p. 28-33)
- Pavlović, Andrija, *Organizacija i razvoj Jugoslovenskog ratnog vazduhoplovstva 1918-1941, III knjiga, period 1937-1941 I deo; V knjiga, period 1937-1941 III deo; VII knjiga, period 1937-1941 V deo* (unpublished text, manuscript in Aviation Museum – Belgrade, Serbia)
- Petrović, Ognjan M. (Огњан М Петровић), *Avioni Vazduhoplovstva vojske Kraljevine Jugoslavije iz nemačkog ratnog plena prema nemačkom popisu od 20.5.1941* (Авиони Ваздухопловства војске Краљевине Југославије из немачког ратног plena према немачком попису од 20. 5. 1941) (Rasinski anali 5, Istorijски архив Крушеvac, Serbia, 2007, p. 327-341)
- Petrović, Ognjan M. (Огњан М Петровић), *Avioni Vazduhoplovstva vojske u Aprilskom ratu, u Braničevo kroz vojnu i kulturnu istoriju Srbije II, Sveska 4* (Авиони Ваздухопловства војске у Априлском рату, у: Браничево кроз војну и културну историју Србије II, Свеска 4) (Istorijски архив Пожареvac, Serbia, 2007, p. 373-406)
- Petrović, Ognjan M. (Огњан М Петровић), *Vojni aeroplani Kraljevine Jugoslavije (modernizacija – engleski tipovi)* (Војни аероплани Краљевине Југославије (модернизација – енглески типови)) (Vesnik 35, Beograd, Serbia, August 2008, p. 91-112)
- Petrović, Ognjan M. (Огњан М Петровић), *Vojni aeroplani Kraljevine Jugoslavije (modernizacija – nemački tipovi) 2. nastavak* (Војни аероплани Краљевине Југославије (модернизација – немачки типови) 2. наставак) (Vesnik 38, Beograd, Serbia, August 2011, p. 91-115)
- Petrović, Ognjan M. (Огњан М Петровић), *Vojni aeroplani Kraljevine SHS/Jugoslavije (deo II: 1931-1941)* (Војни аероплани Краљевине СХС/Југославије (део II: 1931-1941)), Let 3, MJV, Beograd, Yugoslavia, 2004, p. 30-87)
- Petrović, Ognjan M. (Огњан М Петровић), *Minorni tipovi aviona Vazduhoplovstva vojske Kraljevine Jugoslavije 1940-1941* (Минорни типови авиона Ваздухопловства војске Краљевине Југославије 1940-1941) (Rasinski anali 6, Istorijски архив Крушеvac, Serbia, 2008, p. 81-89)
- Petrović, Ognjan M. (Огњан М Петровић), *Lovački avion Ikanus IK-2* (Ловачки авион Икарус ИК-2) (Vesnik 44, Beograd, Serbia, August 2017, p. 97-137)
- Petrović, O (О Петровић), Djokić, N (Н Ђокић), *Ikanus IK-2 prvi domaći lovački avion* (Икарус ИК-2 - први домаћи ловачки авион) (Narodna armija 2726, Beograd, Yugoslavia, 24.8.1991, p. 36)

- Petrović, Ognjan, *Avioni Jugoslovenskog vazduhoplovstva, april 1941. godine* (AERO magazin 2-3/91 (special edition), Sečovlje, Yugoslavia, March-June 1991, insert - drawings, Yugoslav airplanes)
- Petrović, Ognjan, Miklušev, Nenad, *Messerschmitt Me-110* (YASIG Vol. No.3/4, Zrenjanin, Yugoslavia, 1998)
- Petrović, Ognjan (Огњан Петровић), Bradić, Srećko (Срећко Брадић), *Bojenje aviona I deo* (Бојење авиона I део) (Aeroplan 1/95, Beograd, Yugoslavia, September 1995, p. 34-44); *II deo* (II део) (Aeroplan 2/95, Beograd, Yugoslavia, December 1995, p. 18-23)
- Petrović, Ognjan M. et Ognjević, Aleksandar M., *Ikanus IK-2, la moyette yougoslave, Première partie* (Avions #222, France, Mars-avril 2018, p. 74-88); *Seconde et dernière partie* (Avions #223, France, Mai-Juin 2018, p. 52-65)
- Radinger, Willy, Schick, Walter, *Messerschmitt Me-109 von Bf (Me) 109A bis Me 109E* (Aviatik Verlag, Oberhaching, Germany, 1997)
- Robertson, Bruce (compiled by), *British Military Aircraft Serials 1878-1987* (Midland Counties Publications, London, UK, 1987)
- Schmoll, Peter, *Die Messerschmitt-Werke im Zweiten Weltkrieg*, 3rd Edition (MZ Buchverlag GmbH, Regensburg, Germany, 2004)
- Scutts, Jerry, *Hurricane in Action, Aircraft No. 72* (Squadron Signal publication, Carrollton, USA, 1986)
- Shores, Christopher and Cull, Brian with Malizia, Nicola, *Air War for Yugoslavia, Greece and Crete 1940-41* (Grub Street, London, UK, 1987)
- Stankov Dušan (Душан Станков), *Razarač "Zmaj R-1"* (Разарач "Змај Р-1") (Saopštenje Mašinske i Vazduhoplovne grupe Tehničkog fakulteta u Beogradu br. 1, Kingdom of Yugoslavia, July 1940, p. 23-24)
- Terzić, Velimir, *Slom Kraljevine Jugoslavije 1941. uzroci i posledice poraza, knjiga 1 i 2* („Partizanska knjiga“ Ljubljana-Beograd, „Narodna knjiga“ Beograd, „Pobjeda“ Titograd, Yugoslavia, 1984 (drugo izdanje))
- Tešić, Ljubomir, *Prvi i poslednji let "Nezavisnog"* (Front 931, Beograd, Yugoslavia, 4.6.1976)
- Tomić, Miodrag P., Editors Ognjević, Aleksandar M., Petrović, Ognjan M., Miklušev, Nenad M., *Serbian Air Force Memorial* (Миодраг П. Томић, уредили Александар М. Огњевић, Огњан М. Петровић, Ненад М. Миклушев, *Споменица Српског војног ваздухопловства*) (Leadensky Books, Beograd, Serbia, 2015)
- Turina, Milan, F. (Турина Ф. Милан), *Naoružanje kraljevine Jugoslavije* (Наоружање краљевине Југославије) (Beograd, Kingdom of Yugoslavia, 1938)
- Vajda, Ferenc A. & Dancey, Peter, *German Aircraft Industry and Production* (Airlife, Shrewsbury, Shropshire, UK, 1998)
- Vinaver, Dr Vuk, *Jugoslovensko-engleski ugovor o isponuci naoružanja 1940. godine* (Vojnoistorijski glasnik br. 5/1966, Beograd, Yugoslavia, p. 77-78)
- Wawrzynski, Miroslaw, *Hurricane w obcej sluzbe - Hurricane in Foreign Service* (AJaKS-Ksiazki Militarne, Warszawa, Poland, 2001)
- Weal, E., Weal, R. and Barker, R., *Combat Aircraft of World War Two* (Arms and Armor Press, London, UK, 1977)
- Windrow, Martin, C., *The Messerschmitt Bf 109E, Aircraft Profile No 40* (Profile Publications, London, UK, 1966)
- Žutić, Dr Nikola, *Avioindustrija i vazduhoplovstvo u Kraljevini Jugoslaviji 1918-1945* (Merkur, Belgrade, Serbia and Montenegro, 2004)

Annuals

- Almanah Jugoslovenske avijacije 1930* (Алманах Југословенске авијације 1930), Beograd, Kingdom of Yugoslavia
- Almanah Jugoslovenskog vazduhoplovstva 1931-1932, 1932-1933* (Алманах Југословенског ваздухопловства 1931-1932, 1932-1933), Beograd, Kingdom of Yugoslavia
- Godišnjak Jugoslovenskog vazduhoplovstva 1933/34, 1935 to 1941* (Годишњак Југословенског ваздухопловства 1933/34, 1935 до 1941), Beograd, Kingdom of Yugoslavia

Periodicals

- Naša krila* (Наша крила), Beograd, Kingdom of Yugoslavia, 1924-1941
- Aero* (Аеро), Beograd, Kingdom of Yugoslavia, 1938-1941
- Bilten* (Билтен), Petrovaradin, Kingdom of Yugoslavia, 1922-1927
- Vazduhoplovni glasnik* (Ваздухопловни гласник), Novi Sad / Zemun, Kingdom of Yugoslavia, 1927-1941

Selected internet sources:

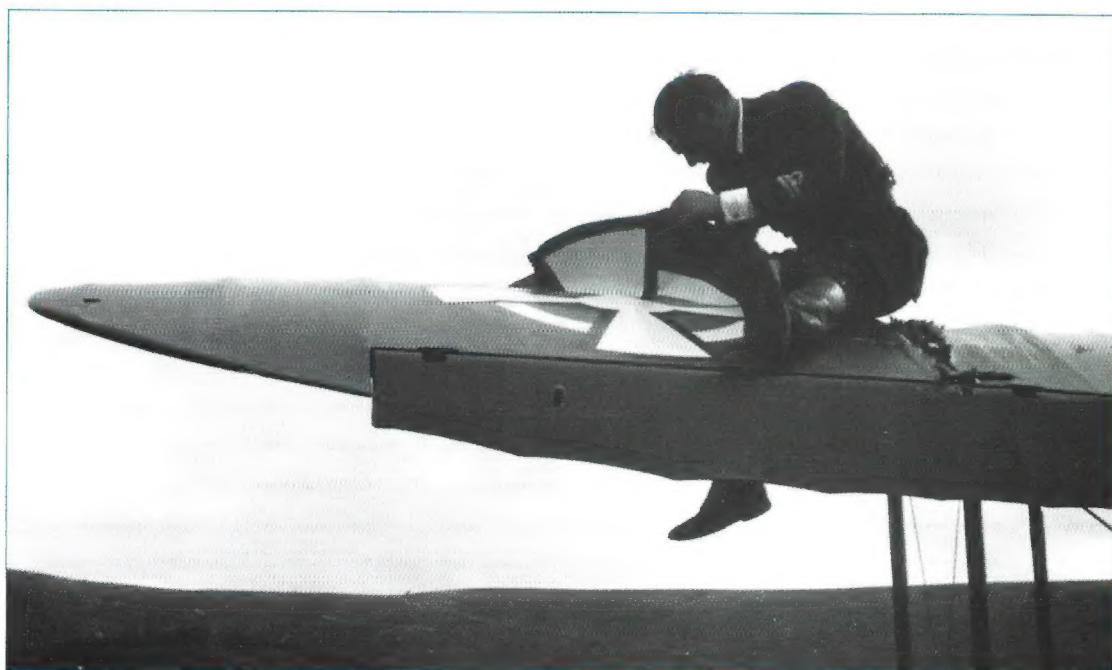
- www.avijacijabezgranica.com/forum
- www.paluba.info/smf
- www.aeromagazin.rs

Institutions:

Archives of Yugoslavia, Beograd, Serbia
Aviation Museum –Beograd, Beograd, Serbia
City of Belgrade Library, Beograd, Serbia
Historical Archives of Belgrade, Beograd, Serbia
Military Archive, Beograd, Serbia
Military Museum – Belgrade, Beograd, Serbia
Musée de l’Air et de l’Espace, Paris, France
National Archives, Washington, USA
National Digital Archive, Warsaw, Poland
Österreichische Nationalbibliothek, Vienna, Austria
Stato Maggiore Aeronautica, Rome, Italy
Technical Museum Brno, Brno, Czech Republic



Original and the only example of “Kosovo cross” insignia known to be in existence, removed from the wing canvas of an unknown VV machine during or after the 1941 April War. Note the relatively well-preserved colours, except for the Blue colour which shows two shades.



An Italian soldier cuts the VV „Kosovo cross” insignia on the upper port wing of a captured FN-Walter trainer (Stato Maggiore Aeronautica)

Yugoslav FIGHTER COLOURS 1918–1941

This second volume describes in detail the camouflage and markings of more of the day fighters used by the Yugoslav Air Force from 1918 to 1941. Aircraft of Yugoslav, British, German, Czech and French origin are shown in many historical photographs and colour profiles showing the colours and markings carried by the aircraft. Detailed colour notes and precise description and illustration of national markings over the period complete a two-book set that will be invaluable to aircraft enthusiasts, historians and modellers.

- Hawker Yugoslav Fury
- Ikarus IK-2
- Hawker Hurricane Mk.I
- Rogožarski IK-3
- Messerschmitt Bf 109E-3a
- Potez 63
- Rogožarski R-313
- Zmaj R-1
- Ikarus Orkan
- Messerschmitt Bf 110C-4

How to Contact Us

Twitter

@mmp_books



Facebook

mmpbooks
wydawnictwo stratus



eMail

office@mmpbooks.biz
biuro@stratusbooks.pl

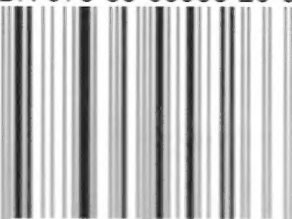


YouTube

mmpbooks



ISBN 978-83-65958-26-6



9 788365 958266